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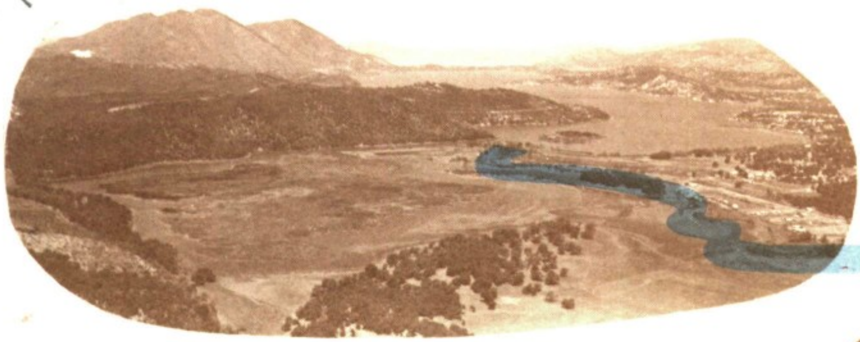
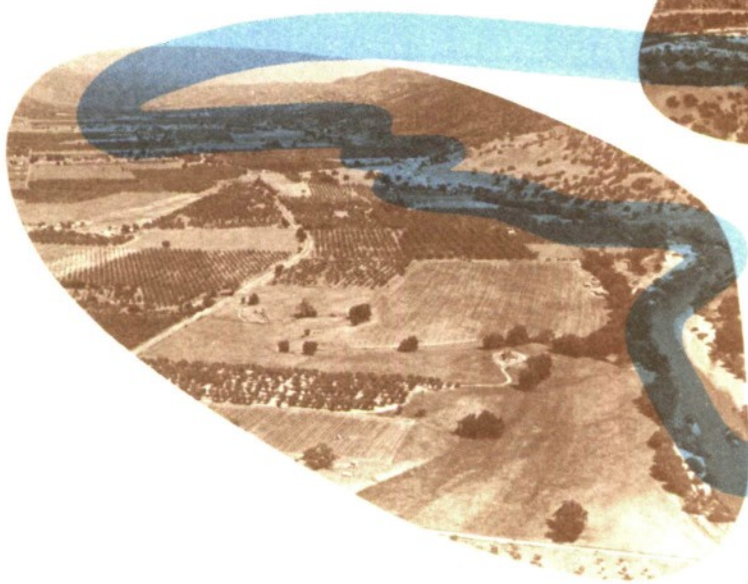
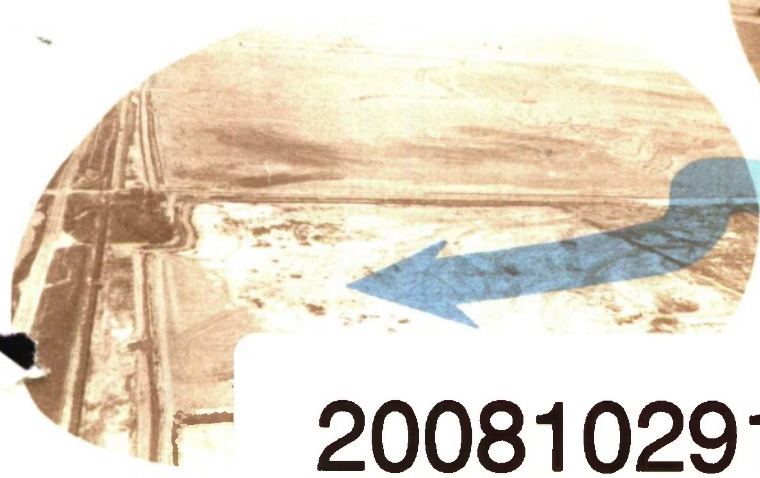


CACHE CREEK BASIN CALIFORNIA



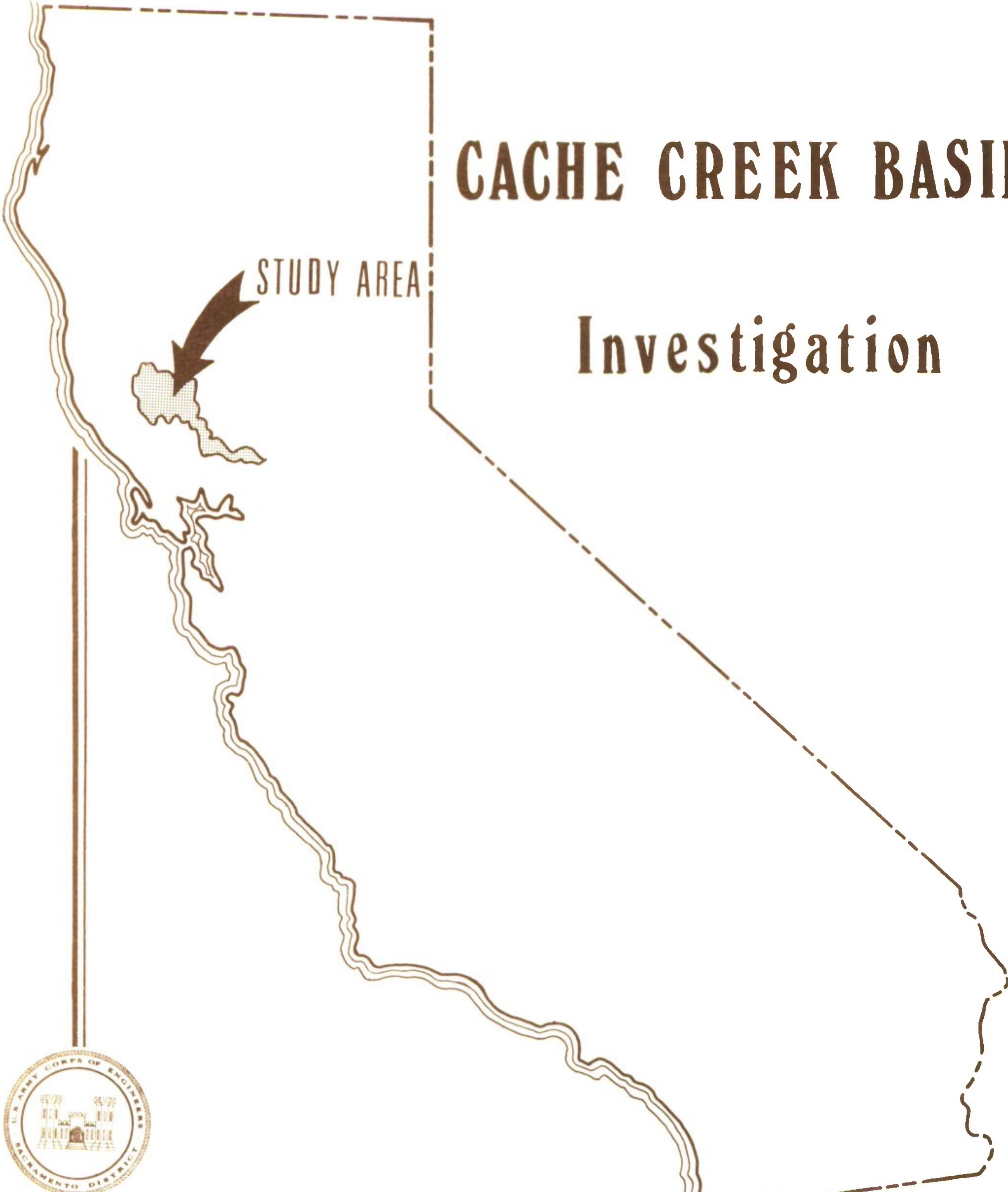
FEASIBILITY REPORT
AND
ENVIRONMENTAL STATEMENT
FOR
WATER RESOURCES DEVELOPMENT



FEBRUARY 1979

CACHE CREEK BASIN

Investigation



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SPDPD-P [Feb 79] 1st Ind
SUBJECT: Feasibility Report for Water Resources Development, Cache Creek Basin, California

DA, South Pacific Division, Corps of Engineers, 630 Sansome Street, Room 1216, San Francisco, California 94111 1 October 1979

TO: HQDA (DAEN-CWP) WASH DC 20314

I concur in the conclusions and recommendations of the District Engineer.

N. G. DELBRIDGE, JR.
Brigadier General, U. S. Army
Division Engineer

SPKED-W

27 February 1979

SUBJECT: Cache Creek Basin Investigation, California; Feasibility Report and Environmental Statement

Division Engineer, South Pacific

1. Inclosed are 36 copies of the subject report dated September 1978 and appendixes 1 through 6 (bound in one volume), including the revised draft environmental statement which has been included as Appendix 4.

2. The report and environmental statement have been revised to reflect: (a) SPD review comments furnished in SPDPD-P 1st indorsement dated 30 November 1977 to SPKED-W basic letter dated 30 August 1977, subject: Cache Creek Basin, California; Feasibility Report and Environmental Statement for Water Resources Development and (b) field review comments from Federal, State, and local agencies and individuals.

3. SPDPD-R multiple letter dated 26 June 1978, subject: Implementation of Executive Order 11990 and Related Guidelines on Wetlands, transmitted a "recommended" format to be used in feasibility reports for presenting an evaluation of the effects of the discharge of dredged or fill material into waters of the United States. However, such an evaluation had already been prepared and printed for the Cache Creek Basin investigation in a different format, as outlined in Appendix B to EC 1165-2-125, transmitted by DAEN-CWP-A letter dated 30 December 1976, subject: Application of Federal Regulations Implementing Section 404 to Civil Works Projects. Since the format outlined in SPDPD-R 26 June 1978 letter is only "recommended," and since the proposed plans of improvement do not include disposal of any dredged or fill material in waters of the United States or adjacent wetlands, the Section 404 evaluation was left in its originally prepared format.

4. Information regarding possible cost apportionment between Federal and non-Federal interests based on future adoption and implementation of the President's recent water policy message was incorporated into the report as follows:

a. A new section entitled "Proposed Revised Cost-Sharing Responsibilities" (Section H) was added to Appendix 1 and includes (1) all information on the proposed criteria and (2) a letter from the State of California Reclamation Board providing intent to furnish necessary requirements of local cooperation under the new criteria.

b. Information from the new Section H was also incorporated into the main report, including a tabulation which summarizes and illustrates the comparative cost-sharing that would be applicable for both current administration policy and for the President's proposed revised policy.

SPKED-W 27 February 1979
SUBJECT: Cache Creek Basin Investigation, California; Feasibility Report and Environmental Statement

c. The report "Syllabus" states that the report includes information on both the traditional and proposed revised cost-sharing methods.

5. Also inclosed are the following:

a. Thirty-six copies of this transmittal letter (inclosure 2).

b. Three copies each of transcripts of public meetings held 2 July 1969, 2 and 4 December 1975, and 20 and 21 March 1978 (inclosures 3, 4, and 5). Each transcript contains the announcement of public meeting, list of interested parties who were furnished the announcement, and list of persons attending.

c. Draft copy of the mailing list for the Division Engineer's "Notice of Completion of Report" (inclosure 6).

d. Seven copies of a briefing map (plate 1) (inclosure 7).

e. Sixteen reduced size prints of plates 1, 2, and 3 (inclosure 8).

f. Three full size prints of plate 1 (inclosure 9).

g. Four copies of draft BERH report (inclosure 10).

h. Four copies of draft of OCE report (inclosure 11).

6. Following issuance of the public notice by the Division Engineer, a display map and appropriate slides, prepared pursuant to ER 1105-2-422, will be forwarded directly to BERH.

7. It should be noted that, based on October 1977 prices, the total Federal first cost for both current and proposed revised cost-sharing criteria is less than $15 million. Consideration should be given to authorization under the authority of Section 201 of the 1965 River and Harbor and Flood Control Act, as amended.

CAPIK/ls

SAIA

11 Incl
as

DONALD M. O'SHEI
Colonel, CE
District Engineer

LUETHY

PRATT

WEDDELL

NICKMAN

O'SHEI

cc:
Engr Div
Prog Dev
WRPB
EPS
Econ Sec
Civ Des Br
Tech Engr Br
Inv Sec A
Inv Sec D (wd)

CACHE CREEK BASIN, CALIFORNIA
FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT
FOR WATER RESOURCES DEVELOPMENT
LAKE AND YOLO COUNTIES, CALIFORNIA

REVISIONS, 15 March 1980

MAIN REPORT

Remove pages	Replace with pages
i, ii	i, ii
iii, iv	iii, iv
9, 10	9, 10
27, 28	27, 28
29, 30	29, 29a
-	30
31, 32	31, 32
37, 38	37, 38
39, 40	39, 40
45, 46	45, 46
69, 70	69, 70
71, 72	71, 71a
-	72
73, 74	73, 74
75, 76	75, 76

APPENDIX 1

Remove pages	Replace with pages
B-11, B-12	B-11, B-11a
-	B-12
C-i, C-ii	C-i, C-ii
C-21, C-22	C-21, C-22
C-25, C-26	C-25, C-25a
-	C-26
C-31, C-32	C-31, C-32
C-37, C-38	C-37, C-38
C-59, C-60	C-59, C-60
-	C-60a
D-41, D-42	D-41, D-42
D-49, D-50	D-49, D-50
D-51, D-52	D-51, D-52
-	D-52a

Remove pages	Replace with pages
E-i, E-ii	E-i, E-ii
E-3, E-4	E-3, E-4
E-5, E-6	E-5, E-5a
-	E-5b, E-5c
-	E-5d, E-6
E-7, E-8	E-7, E-8
E-19, E-20	E-19, E-20
Plate E-10	Plate E-10
F-i, F-ii	F-i, F-ii
F-iii	F-iii
F-13, F-14	F-13, F-14
F-15, F-16	F-15, F-16
F-17, F-18	F-17, F-18
F-33, F-34	F-33, F-33a
-	F-34
F-37, F-38	F-37, F-38
F-39, F-40	F-39, F-39a
	F-39b, F-40
F-47, F-48	F-47, F-48
F-49, F-50	F-49, F-50

Add Plates F-4 to F-8

APPENDIX 2

5, 6	5, 6

APPENDIX 4

Unnumbered page following App 4 title page	Replace with revised page
i, ii	i, ii
iii, iv	iii, iv
v, vi	v, vi
5, 6	5, 6
15, 16	15, 16
17, 18	17, 17a
-	18

CACHE CREEK BASIN, CALIFORNIA

FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT FOR WATER RESOURCES DEVELOPMENT LAKE AND YOLO COUNTIES, CALIFORNIA

TABLE OF CONTENTS

Rev. 15 March 80

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

LIST OF PHOTOGRAPHS

LIST OF PHOTOGRAPHS (Cont'd)

Some small game and fur bearing animals inhabit the lower part of the basin below Rumsey, but their natural habitat is limited. Since the channel is dry most of the year, the fishery is insignificant. Lower Cache Creek is within the Pacific Flyway used by 10-12 million ducks and geese of which 300,000 utilize the Yolo Bypass (which includes the Cache Creek Settling Basin) as a wintering area.

Archeological investigations have established Clear Lake as the site of human life for at least the past 8,000 years. Before the coming of the white man, Lake County was inhabited by about 5,000 Indians, making it one of the more populated areas in the State. Generally, Indians in the Cache Creek Basin are classified as Pomo, Lake Miwok, and Patwin. Recent surveys within the Clear Lake-Cache Creek Basin have located 28 archeological sites, some of which appear to have considerable antiquity. A Patwin site 6 miles northwest of Clear Lake is on the National Register of Historic Places. Sites along Clear Lake Outlet Channel have not been excavated, but the Department of Anthropology of the University of California, Davis, has conducted limited test excavations in the foothills of Capay Valley. One large village on the right bank of Cache Creek has provided the oldest evidence of human occupation in Capay Valley, and a small portion of the site has been excavated.

White settlers entering the Clear Lake region between 1850 and 1855 displaced and disrupted much of Lake County's Indian population. In a short time, large portions of the valley became privately owned; agriculture, mining, and lumbering flourished; and resort businesses began around the many mineral springs. Lake County was officially organized in 1861, with Lakeport as the county seat.

Cache Creek in Yolo County is rich in historical lore and played a crucial role in the settlement and development of the region. The name Cache Creek came from the fur trappers "caching" their furs along the stream. Fur trapping was one of the earliest activities of white men, and in 1829 the first fur brigade in the Sacramento Valley camped at French Camp 1 mile east of Yolo on the north side of Cache Creek. The earliest permanent settlements were also established along Cache Creek. Yolo was one of California's original 27 counties in 1850, and the town of Yolo, originally called Cacheville, became the first county seat in 1857. From its beginning to the present, Yolo County's rich agricultural resources have dominated the county's history and expansion.

Human Resources and Economic Development

Out of 58 counties, Lake County ranks 41st and Yolo County 28th in California county populations. While there are no large urban developments in Lake County, those areas that are urbanized are located around the Clear Lake rim, where most of the population of the upper basin live. Lake County ranks first in California in percentage of population over age 65, and the current 5.7 percent growth rate is mostly from retirees 65 years or older. Birth rates in Lake County are lower than the average State rate because many young adults have migrated to metropolitan areas in search of employment and educational opportunities. From Memorial

Day to Labor Day, the seasonal vacation population of about 80,000 exceeds the number of permanent residents (27,600). Over 55 percent of the housing units in Lake County are summer homes or cabins. Since there are no zoning restrictions in type of housing, lower quality homes are interspersed with expensive, higher quality homes, mobile homes, and semipermanent and vacation trailers.

Lake County depends on agriculture and trade and services jobs relating to summer recreation. Although commercial trade and services represent the largest source of employment, growth has been slow. Employment in agriculture and food processing has declined since 1950.

Yolo County had an estimated 1976 population of 104,700. Much of the recent population growth has been the result of inmigration into the incorporated areas of Woodland and Davis. Woodland, with an estimated population of 25,150 in 1974, is the only major population center partly in the Cache Creek Basin.

In the past 5 years, industry has expanded and diversified in Yolo County. However, since agriculture remains the most important influence on the labor market, seasonal unemployment is serious in rural areas during the winter. Unskilled workers generally are surplus throughout the year. Per capita personal income projections for California and Lake and Yolo Counties are shown on the following page.

City of Woodland with Interstate 5 in Foreground
January 1974

Interim measures to increase the storage capacity, including raising the Cobble Weir at the outlet of the settling basin and manipulating the training levees, have prolonged the settling basin's efficiency in trapping sediment. With the depletion of storage space in the settling basin, Cache Creek's heavy sediment load is being carried into the Yolo Bypass unimpaired, affecting the bypass floodflow capacity. Also, additional sediment flows downstream, compounding the sediment deposition problems in flood control and navigation channels such as the Sacramento River Deep Water Ship Channel and San Francisco Bay system. About 11 million cubic yards is annually dredged from these critical problem areas. If no action is taken, an estimated 340 acre-feet annually (550,000 cubic yards) of sediment that formerly deposited in the settling basin will flow into the bypass with about 240 acre-feet depositing in the lower bypass, navigation channels, and the San Francisco Bay system.

Municipal and Industrial Water Supply Needs

LAKE COUNTY

Ground water is the major source of municipal and industrial (M&I) water supply in the vicinity of Clear Lake, but some water supply is also provided by the lake. The Corps authorized Lakeport Lake project, currently deferred due to lack of local assurances, would supplement the M&I water supply by providing an additional 8,400 acre-feet annually to the Lakeport area. Pomo Reservoir on Kelsey Creek, being studied by Lake County, also would supplement M&I water supply of the Clear Lake area.

YOLO COUNTY

The larger cities in Yolo County, such as Woodland, Davis, and Winters, obtain their entire water supply from ground water, and it is predicted that wells will continue to be used for M&I water supply in the future.

Irrigation Needs

LAKE COUNTY

Although within Lake County, Clear Lake provides only a limited source of irrigation water for Lake County, since Yolo County Flood Control and Water Conservation District owns most of the rights to water stored in the lake. As set forth in the 1920 Gopcevic Decree, Yolo County has use of Clear Lake water for irrigation purposes between the stages of zero and 7.56 feet on the Rumsey gage at Lakeport. However, in utilizing this water, evaporation and other losses must be considered. Irrigation water supplies can be developed on the streams flowing into the lake. The authorized Lakeport Lake project on Scotts Creek could provide 9,100 acre-feet annually of irrigation water. Also, as previously discussed, Pomo Reservoir would furnish irrigation water to the Big Valley area adjacent to Kelsey and Adobe Creeks.

YOLO COUNTY

Yolo County is primarily an agricultural county, and water for agriculture is obtained from ground and surface water supplies. Clear Lake, Indian Valley Reservoir, Cache Creek, and the Sacramento River are the primary sources of surface water. Recent studies indicate that combined sources of surface and ground water are nearly sufficient to meet demands. However, more water will be needed to irrigate land not presently used for agriculture. The Bureau of Reclamation is making studies of the Yolo County area to determine additional needs and feasibility of providing further water supply.

Water Quality Problems

CLEAR LAKE

The most significant water quality problem in Clear Lake is the excessive algal growth caused by the rich nutrient content of the lake. When wind-swept to the shoreline, the algae die, producing an unsightly appearance and giving off an unpleasant odor to the detriment of recreation, which is one of the major beneficial uses of the lake. Irrigation water for downstream users, the second major beneficial use of Clear Lake, is satisfactory for the crops grown.

The Clear Lake Algal Research Unit (CLARU) has conducted rigorous studies and tests on the causes and control of algal blooms in Clear Lake and has attempted to find a means to "tip the ecological balance" so that the growth of nonobnoxious green algae is favored over the growth of the obnoxious blue-green algae. CLARU is continuing to seek a solution to water quality problems at Clear Lake.

CACHE CREEK

The major beneficial use of Cache Creek is irrigation water supply. Currently, the water of Cache Creek as it leaves Lower Arm of Clear Lake is a suitable quality to satisfy downstream irrigation uses. Downstream of Clear Lake Dam, Bear Creek, which flows into Cache Creek, has a relatively high boron content, so crops irrigated with lower Cache Creek water have to be insensitive to the boron concentrations. Other beneficial uses of Cache Creek, such as fishery and recreation, are satisfactorily met by the present water quality.

Fish and Wildlife Needs

The California Department of Fish and Game in its report on "The Fish and Wildlife Resources of Anderson Marsh, Clear Lake, Lake County," dated January 1974, concluded that Anderson Marsh and other associated wetlands are vital segments in Clear Lake's natural resource production, maintenance, and perpetuation. These resources will be further jeopardized if reduced or committed to nonresource use. Fish and Game has been attempting to preserve a wildlife area adjacent to the lake and is considering purchase of the Anderson Ranch, a portion of which is a natural marsh area, and development of a wildlife refuge.

Clear Lake is widely known as an excellent fishery for warmwater species of fish, and the Clear Lake area is inhabited by many species of wildlife. Cache Creek and its tributaries provide minor fisheries for smallmouth bass and white catfish.

At the mouth of Cache Creek, the settling basin currently contains some lands that are not used for agriculture, thereby allowing maximum use for wildlife. However, the U.S. Fish and Wildlife Service and Department of Fish and Game are concerned that the amount of unused land is continually diminishing. In addition, the U.S. Fish and Wildlife Service has determined that the Central Valley of California provides wetland habitat which is critically important for Pacific Flyway wintering waterfowl. The continued destruction of wetlands in California has caused a shortage of wintering habitat relative to the breeding habitat in northern portions of the continent so that wintering habitat may be limiting to some Pacific Flyway populations. The Fish and Wildlife Service's "Concept Plan for Waterfowl Wintering Habitat Preservation-Central Valley California" (1978) ranks the Yolo Bypass area (which includes the Cache Creek Settling Basin) second only to the Sacramento-San Joaquin Delta in priority for development of new wintering areas based on desirability, potential value, and feasibility of development.

General Recreation Needs

About 39 miles of Clear Lake's 100-mile shoreline has been intensively developed for water-associated recreation, including lakeside residences, public and private beaches, and wharfs. Because the Clear Lake Water Company operates Clear Lake to obtain a water supply for agriculture, the lake is drawn down during the late summer. During years of low inflow to the lake, this lowering of the lake level is considered a detriment by recreation interests. As discussed in "Water Quality Problems," another major detriment to recreation is the growth of blue-green algae in Clear Lake. Lake County has indicated it does not support constructing additional recreation facilities around Clear Lake.

At present little recreational use is made of the main stem of Cache Creek or of its tributaries; however, whitewater boating on North Fork Cache Creek and Cache Creek has grown in popularity. Adjacent lands are used for limited deer and quail hunting. A county park has recently been developed along Cache Creek in the vicinity of Rumsey. Along lower Cache Creek in the vicinity of the Yolo Bypass, there is limited waterfowl hunting. Hunting opportunities are now limited due to lands being in private ownership.

Improvements Desired

At the public meeting held in Woodland on 2 July 1969, local interests expressed their desires for improvements varying from channel stabilization to multipurpose storage reservoirs and restriction of aggregate mining from portions of Cache Creek. The Reclamation Board of the State of California, which maintains and operates the Sacramento River Flood Control Project, desires a long-range solution to the settling basin problem to prevent sediment deposition from reducing the flood-carrying capacity of the Yolo Bypass. Lake and Yolo County water agencies indicate a need for additional irrigation water supply in both the upper and lower basins to supplement diminishing ground water supplies. Lake County officials would like to have the water quality improved and the lake level stabilized to enhance recreation potential and control flooding of the lake perimeter.

At the public meetings held 2 and 4 December 1975, the Reclamation Board favored further detailed studies of flood control alternatives involving enlargement of the Clear Lake Outlet Channel and construction of an adjacent bypass channel; and supported further studies of any plan to (a) raise and enlarge the levees of the settling basin, or (b) excavate material from the basin, or (c) expand the basin, or (d) a combination of any of these plans which will provide a good feasible solution to the sedimentation problem. Lake County indicated by letter dated 22 December 1975 that the recreation features shown at the public meeting, consisting of campgrounds and associated facilities and improved access along the outlet channel and to Garner Island, should not be included in the project. The primary objection to recreation development as part of a Federal project was that it would compete with such development by local interests. Yolo County has voiced no objection to development of recreation facilities in lower Cache Creek Basin.

Planning Objectives

The two national water resources planning objectives as identified in the Water Resources Council's Principles and Standards are National Economic Development and Environmental Quality. Under National Economic Development the objective is to efficiently increase the value on the nation's output of goods and services and improve national income. For Environmental Quality, the objective is to enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of national and cultural resources.

For the Cache Creek Basin specifically, planning objectives were also established to provide for problems and needs which were identified. The authorization for the Cache Creek Basin Investigation made particular reference to the flood problem at Clear Lake and the need to modify the Cache Creek Settling Basin. Therefore, flood control at Clear Lake and sediment control at the settling basin were established as primary planning objectives. As indicated, the area around Clear Lake has been subject to damaging floods for many years. Lake County is participating in the National Flood Insurance Program which will reduce the flood damage potential in the Clear Lake area; however, damages to existing development will continue to occur frequently. Also, the Cache Creek Settling Basin, constructed in the 1930's, is now filled and sediment originating from Cache Creek is depositing downstream in flood control and navigation channels.

Review of other Cache Creek Basin problems and needs indicated that certain of the problems and needs are either being addressed for solution by other agencies or no interest was expressed by local interests in pursuing a solution. One additional objective, however, which was identified from the review was wildlife preservation and enhancement in the vicinity of the Cache Creek Settling Basin.

Formulating the Plans

The plan formulation process used in selecting a plan is described in this section. Formulation and evaluation criteria are outlined, the two main problem areas are discussed, and the 19 alternative solutions are identified and described. Also, the subsection "Selecting the Plans" briefly describes the two best plans and the reasons for their selection.

Formulation and Evaluation Criteria

The alternative plans of improvement were formulated and evaluated based on their technical, economic, environmental, and socioeconomic impacts on the Clear Lake-Cache Creek areas. Plan formulation criteria include the Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources" (P&S), dated 10 September 1973, and implementing regulations developed by the Corps of Engineers.

TECHNICAL CRITERIA

The following criteria were adopted in developing the plans:

a. The plans should be consistent with the California Water Plan and the General Plans for Lake and Yolo Counties.

b. Provisions should be made for drainage of lands adjacent to proposed levees.

c. Plans developed should be consistent with provisions of the National Flood Insurance Program.

d. During the flood season, the storage of Clear Lake should be controlled, to the maximum extent possible, to the current nondamaging level of 7.56 feet on the Rumsey gage at Lakeport. The nondamaging Cache Creek flow of 20,000 cfs at the downstream community of Rumsey should be a factor in determining operation of Clear Lake for flood control.

e. Clear Lake should be operated so that the existing water rights are preserved.

f. Historical sediment flow and deposition should be used as a basis for future storage requirements.

g. Sediment control life should be as long as possible, considering constraints of physical practicality and economic feasibility.

h. At least 50 percent sediment trap efficiency should be provided since historically this degree of trap efficiency has permitted adequate control of the Cache Creek sediment flow.

i. Flood control evaluations should be conducted assuming the authorized Lakeport Lake project would not be in operation. This assumption is consistent with recent reclassification of the Lakeport Lake project to "deferred" status.

ECONOMIC CRITERIA

Economic criteria for formulation of the plans are summarized as follows:

a. The benefits and costs should be expressed in comparable terms as fully as possible. All evaluations of alternatives should be based on October 1977 prices, an interest rate of 6⅝ percent, and 100- and 50-year project lives for flood control and sediment control alternatives, respectively.

b. Each alternative considered in detail must be "justified" in the sense that total beneficial effects (monetary and nonmonetary) associated with the objectives are equal to or exceed the total adverse effects (monetary and nonmonetary) associated with the objectives.

c. The selected plans must have net national economic benefits unless the deficiency in net benefits incurred is associated with attaining environmental quality objectives.

d. The size of the flood control project selected should be based on providing the maximum net benefits; however, environmental quality and intangible considerations could dictate a project larger or smaller in size which would forego some of the net tangible benefits.

e. Project benefits should be based on analysis of conditions without and with a project, using methodology described in P&S and Corps of Engineers regulations.

ENVIRONMENTAL CRITERIA

The following environmental criteria are applicable to the formulation and evaluation of plans:

a. Plans should be formulated to the extent practicable to preserve and enhance the quality of the natural environment, specifically including fish and wildlife, vegetation, land, air, water, open space, and scenic and esthetic values.

b. Detrimental environmental effects should be avoided where possible, and feasible mitigation for unavoidable effects should be included.

c. The relationship of the proposed action to land use plans should be considered, and the environmental impact of any proposed action should be evaluated. Any adverse environmental effects which could not be avoided, if a proposal were implemented, should be delineated; alternatives to such proposed action should be identified; the relationship between local short-term uses and the maintenance or enhancement of long-term productivity should be determined; and any irreversible and irretrievable commitments of resources involved if a proposed action were implemented should be identified.

SOCIOECONOMIC CRITERIA

The following socioeconomic criteria are applicable in this study:

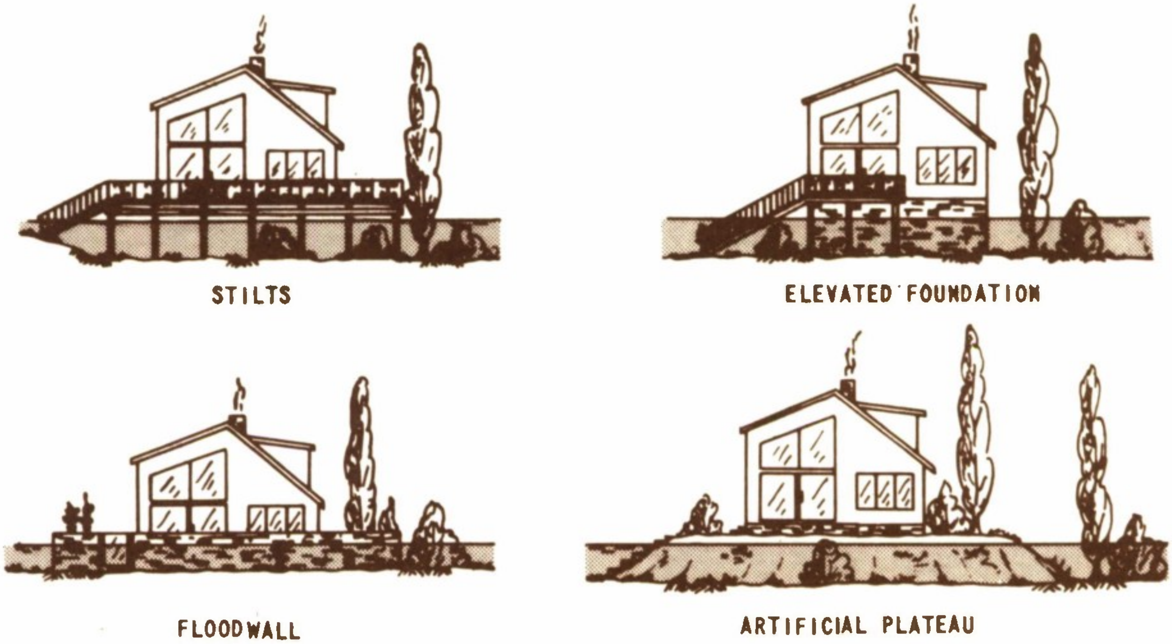
a. Consideration should be given to evaluating and preserving historical, archeological, and other cultural resources.

b. Consideration should be given to safety, health, community cohesion, and social well-being.

c. Displacement of people should be minimized to the extent practicable.

d. Improvement of leisure activities and public facilities should be evaluated.

e. Effects of a project on regional development, including income, employment, business and industrial activity, population distribution, and desirable community growth, should be considered.



METHODS OF FLOOD PROOFING

Plan 5 - Flood Proofing Future Facilities. - (Flood proofing future development is considered economically feasible and is, therefore, discussed in the "Alternatives Considered Further" subsection.)

Plan 6 - Reservoir Storage on Tributaries. - Numerous storage reservoirs would be necessary to adequately reduce flooding on Clear Lake. At least 100,000 acre-feet of tributary storage would be needed to provide a reasonable degree of flood protection to the Clear Lake periphery. The drainage area of Clear Lake is about 520 square miles, and about 20 percent of the inflow enters from Scotts Creek and another 20 percent from Kelsey Creek. The many other streams draining into the lake produce much less flow, and also dam and reservoir sites on the remaining streams are generally poor. The authorized Lakeport Lake project of the Corps of Engineers is located on Scotts Creek and would provide flood control, water supply, fish and wildlife enhancement, and recreation. Lakeport Lake would have 24,000 acre-feet of flood control space and reduce Clear Lake flood stages less than 0.5 foot. Lakeport Lake is currently in a deferred status since local interests are unable at this time to provide the necessary assurances of local cooperation. On Kelsey Creek studies have been made by the Corps and Lake County of developing a 40,000 acre-foot reservoir at the Pomo site. Based on topography, the Pomo site is a good dam and reservoir site. Construction cost would be about $30 million and average annual cost would be about $2 million. Operation of Pomo Lake for flood control only would reduce Clear Lake flood stage by about 1 foot. However, considering that annual equivalent damages on Clear Lake rim total only $1.35 million, construction of Pomo Dam and lake would not be economically feasible. Multiple-purpose use of Pomo Lake was considered, but the benefit-cost ratio would be less than 0.5 to 1. Considering the limited potential for development of storage on Kelsey Creek and other tributaries, this plan was not considered further.

Plan 7 - Modify Operation of Clear Lake for Flood Control. - With this plan, the filling curve for Clear Lake would be revised so that the lake would not be allowed to fill until later in the spring. However, since recreation-oriented development on the lake rim depends on high summertime lake stages and agricultural concerns downstream in Yolo County depend on irrigation water supply, modification of existing lake levels for flood control is not supported by local interests. Also, such modification would be in violation of water rights agreements between Lake and Yolo Counties. These agreements would be difficult to modify in the interest of flood control; therefore, this plan was not considered further.

Plan 8 - Clear Lake Outlet Channel Enlargement

Plan 9 - Clear Lake Outlet Channel Enlargement and Bypass

Plan 10 - Clear Lake Outlet Channel Enlargement and Modified Bypass

(Plans 8, 9, and 10 provide net benefits and are, therefore, discussed in the "Alternatives Considered Further" subsection.)

LOWER BASIN (Cache Creek)

Plan 11 - No Action. - (The "no action" alternative is not considered viable because uncontrolled sediment deposition in the Yolo Bypass would continue. This alternative is, however, discussed further in the "Alternatives Considered Further" subsection in order to compare the effect of proposed plans to conditions expected to occur with no Federal participation.)

Plan 12 - Nonstructural Flood Control Alternatives. - Because the major portion of the flood plain in the lower basin is at present used for agriculture and is expected to continue to be so used, nonstructural measures would not aid in preventing flood damages and, therefore, were not considered further. The State of California Reclamation Board has recently considered adoption of a designated floodway in the reach from about Interstate 5 upstream to Rumsey. Public hearings have been held, and further consideration is being given to adoption of the floodway.

Plan 13 - Raise Settling Basin Levees

Plan 14 - Raise Settling Basin Levees with Wildlife Refuge

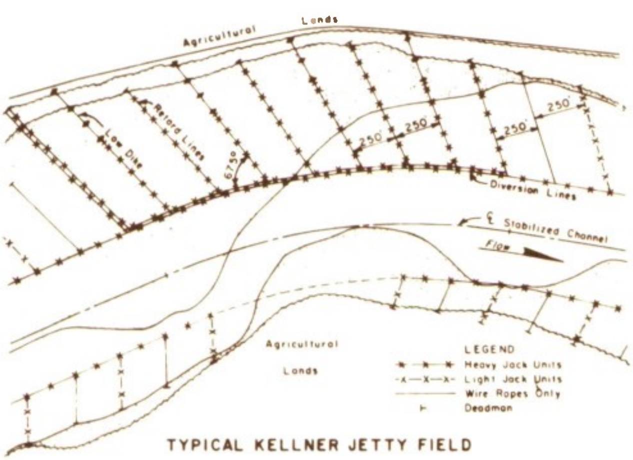
(Plans 13 and 14 were determined to be feasible and are, therefore, discussed in the "Alternatives Considered Further" subsection.)

Plan 15 - Excavate Settling Basin. - With this plan, the existing 3,600-acre basin would be purchased and, for optimum use, converted to a national or State wildlife refuge. Sediment would be removed periodically from the existing basin, thereby reestablishing its storage capacity and allowing about 60 percent of the sediment currently discharging into the Yolo Bypass to be trapped in the basin. However, because only about one-tenth of the sediment is potentially marketable and because removing and hauling is much more expensive than constraining sediment to the existing basin, this alternative was not considered further. Plans 13 and 14 were considered more practical and economical solutions to the sediment problem. A photograph of the settling basin and adjacent facilities is shown on plate 3.

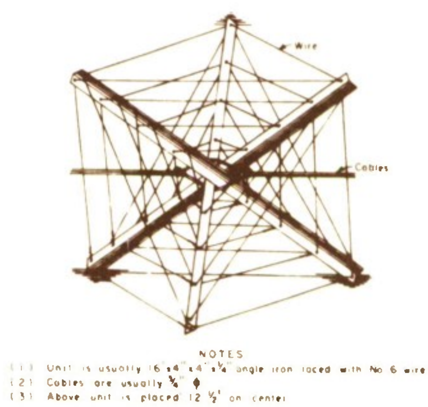
Plan 16 - New North Settling Basin. - Cache Creek flows would be diverted into a new settling basin north of the existing basin where productive agricultural lands are located. However, because of its limited storage capacity of 8,500 acre-feet (25-year storage), this plan would not provide a long-term solution; therefore, the plan was not considered further.

Plan 17 - New South Settling Basin. - Cache Creek flows would be diverted under Interstate 5 into a new settling basin south of the existing basin where less desirable agricultural lands are located; however, because the costs for relocating the railway along the southern boundary of the existing basin and constructing Interstate 5 highway structures over the channel would be very high in comparison to other more practical sediment control solutions, this alternative was not considered further.

Plan 18 - Kellner Jetty System. - This system, shown in the following sketch, consists of iron jacks tied together with steel cable and anchored to the streambank. The system would cost about $5.3 million to install. Sediment would deposit upstream within the system, thus decreasing the amount reaching the Yolo Bypass. However, this plan was not considered further because the jetty fields would be inefficient in trapping sediment and would require continued removal of sediment to assure a long-term life. The cost to move and place the required amount of material would be in excess of $17 million over the 50-year project life. Since only a 33 percent trap efficiency could be provided, additional downstream sediment control works would be necessary. Furthermore, wildlife agencies and environmental concerns strongly oppose such a jetty system.



TYPICAL KELLNER JETTY FIELD



STANDARD UNIT KELLNER JACK

Plan 19 - Brooks Sediment Reservoir. - With this alternative a sediment reservoir would be constructed upstream near the town of Brooks. This reservoir would function as a large detention basin which would cause deposition as water ponded and flow velocities decreased. However, the first cost of this sediment reservoir would be nearly $35 million, which is far in excess of potential sediment control benefits that would be provided; thus, this plan is not economically feasible. Also, nearly 3,000 acres of the scenic and highly productive Capay Valley would be inundated over the life of the project. For these environmental and economic reasons, this alternative was not considered further.

Alternatives Considered Further

As previously discussed, many of the plans were eliminated from further consideration because of limited economic feasibility, significant environmental problems, or limited potential for providing long-term solutions. The alternatives discussed below were selected for further consideration, and a summary of the economic, environmental, and social effects of each plan is presented in tables 1, 2, and 3. Note that each of these plans which call for Federal participation is economically feasible.

UPPER BASIN (Clear Lake)

No Action (Plan 1) - The Federal Government would take no action, either by structural or nonstructural measures, to reduce flood damages. However, as a participant in the National Flood Insurance Program, Lake County has enacted zoning ordinances to control and regulate land use and construction within the 100-year flood plain (land area inundated once per hundred years, on the average). Nevertheless, potential storms could again cause flooding and related damages, which in the future could be more costly even with restrictions imposed upon future development on the Clear Lake rim. In 1958 about 4,000 acres of residential, commercial, and agricultural lands were inundated, causing an estimated $878,000 in damages (1958 prices), and in January 1970 about 1,600 acres were flooded around the rim of the lake, with damages estimated at $485,000 (1970 prices). With "no action" existing streamflow and lake characteristics or patterns would not be modified, and riparian vegetation and wildlife habitat would be disturbed by natural processes or flooding and continued development on the lake rim. "No action" is considered unacceptable because the serious flood problem on the Clear Lake rim would not be alleviated. A photograph of the Clear Lake Outlet Channel and adjacent facilities is shown on plate 2.

Flood Proofing Future Facilities (Plan 5) - As discussed previously, Lake County as a participant in the National Flood Insurance Program is required to adopt ordinances or other controls to regulate land use and construction within the 100-year flood plain (land area inundated once per hundred years, on the average). With this alternative, future development would, additionally, be required to be flood proofed to the level of the Standard Project Flood, which is a flood representing the critical flood runoff volume and peak discharge that may be expected from the most severe combination of meteorologic and hydrologic conditions that are considered reasonably characteristic of the hydrologic region involved. For Clear Lake, the Standard Project Flood corresponds to a Clear Lake stage of about 13.01 feet (1,331.66 feet m.s.l.) on the Rumsey gage at Lakeport. Flood proofing would consist of elevating future buildings on pads or piles, constructing dikes, providing watertight closures and anchorage systems, waterproofing, or using any other such method designed to resist inundation. Because expenses would be borne by individual property owners, the increased costs of flood proofing may tend to discourage development in the Standard Project Flood plain; consequently, this plan would satisfy wildlife agencies and environmental interests concerned that the area is already

Bypass," is not favored by local interests because the longer, 1.6-mile-long bypass channel would increase construction, operation, and maintenance costs.

The nonstructural alternative considered further (Plan 5, "Flood Proofing Future Facilities") is unacceptable to local interests because existing development would not be protected. A comparison of plans developed in detail is shown in Table 1, Summary of Economic-Environmental-Social Effects, Clear Lake Flood Control Alternative Plans.

LOWER BASIN (Cache Creek)

Plan 14, "Raise Settling Basin Levees with Wildlife Refuge," was identified in plan formulation studies as the best plan to limit flow of Cache Creek sediment into the Yolo Bypass. Also, a wildlife refuge established within the settling basin would assist in preserving wetlands and enhancing wildlife, and reduce crop depredation losses in surrounding areas.

Plan 13, "Raise Settling Basin Levees," was also considered further; however, although this plan was technically sound and economically feasible, it provided lesser benefits than did Plan 14 and did not enhance wildlife. Selection of Plan 14 over Plan 13 is consistent with economic, environmental, and socioeconomic criteria listed in Section D of Appendix 1.

A comparison of plans developed in detail is shown in Table 2, Summary of Economic-Environmental-Social Effects, Sediment Control Alternative Plans.

The Selected Plans

This section contains descriptions of the selected plans which were formulated and identified in the preceding section. Also included are general descriptions of plan components and significant design, construction, and operation and maintenance aspects as well as accomplishments of the plans. Environmental, cultural, social, and economic effects of the selected plans are discussed in detail in the Environmental Statement, appendix 4.

Upper Basin (Clear Lake)

PLAN DESCRIPTION

As shown on plate 2, the plan selected to best meet flood control requirements of the Upper Basin (Clear Lake) consists of the following:

- Widening and/or deepening 3.3 miles of the existing 5-mile-long Clear Lake Outlet Channel to a capacity of 8,000 cubic feet per second (cfs) at a Clear Lake stage of 7.56 feet on the Rumsey gage at Lakeport.

- Constructing a 1.1-mile-long bypass channel around the highly developed area adjacent to the existing channel.

- Improve fish and riparian habitat in the main channel and bypass channel by constructing potholes in the channel bottom and riparian plantings along cleared areas of the main channel and bypass.

- Requiring future development to flood proof or otherwise construct above the elevation of the preproject 100-year flood plain.

- Releases from Clear Lake would be controlled by a modified operation of Clear Lake Dam, which is currently operated for water supply and flood control by Yolo County.

An artist's concept of the bypass channel is shown on page 47.

PLAN ACCOMPLISHMENTS

Major accomplishment of the plan would be reduction in flood damages to both existing and future development on the Clear Lake rim. Also, existing and potential urban areas and approximately 4,100 acres of existing and future agricultural areas would be protected from floods. It would reduce the level of the 100-year flood stage on Clear Lake by 2.25 feet, with an average annual decrease in flood damages of $1,170,200.

EFFECTS OF THE PLAN ON THE ENVIRONMENT

Primarily, the proposed plan would provide flood protection to homes, commercial developments, and agricultural crops encircling the Clear Lake rim, thus enhancing not only the quality of the human environment but the local economy as well. Although vegetation would be disturbed by enlargement of the existing channel, additional riparian vegetation would be planted, and new riparian vegetation would be created along the banks of the 1.1-mile-long bypass channel. The U.S. Fish and Wildlife Service by letter dated 26 July 1977 stated that it did not foresee the need to recommend any land acquisition for mitigative purposes. It further stated that this position had been coordinated with the California Department of Fish and Game. Results of Fish and Wildlife Service studies also showed that the more rapid drawdown of Clear Lake during flood periods would have no effect on Anderson Marsh because the project

Review By Other Federal Agencies

Letters received from other Federal agencies expressing views and recommendations concerning the draft feasibility report and EIS are contained in Appendix 2 and summarized below.

- Advisory Council on Historic Preservation

By letter dated 8 March 1978, the Advisory Council on Historic Preservation stated that the Corps of Engineers understands its responsibilities regarding historic preservation requirements. They look forward to working with the Corps in carrying out these responsibilities in the future.

- Department of Agriculture, Soil Conservation Service

By letter dated 30 March 1978, the Soil Conservation Service (SCS) noted that there are no controversial items in the report within the realm of the Service's expertise and responsibilities and no conflict with any SCS ongoing or planned programs or projects.

- Department of Commerce

By letter dated 20 April 1978, the Department of Commerce furnished comments by the National Weather Service (NWS) that NWS provides a river and flood forecast and warning service for Cache Creek at Yolo, Capay and Rumsey, and Lakeport on Clear Lake. NWS felt these services should be referenced as a nonstructural approach to mitigating flood losses. In this report and Section D of Appendix 1, a discussion of flood forecasting as a nonstructural flood control alternative is included.

- Department of the Interior

Bureau of Indian Affairs

By letter dated 25 April 1978, the Bureau of Indian Affairs stated that it found no adverse impact upon any Indian lands under its jurisdiction.

Bureau of Mines

By letter dated 29 March 1978, the Bureau of Mines stated that minerals should be mentioned or acknowledged in the environmental statement. A discussion has been included in this report, the final EIS, and Section B of Appendix 1.

Bureau of Land Management

By letter dated 20 April 1978, the Bureau of Land Management (BLM) notes that it estimates no major impact on BLM lands due to the project.

- Bureau of Reclamation

By letter dated 7 April 1978, the Bureau of Reclamation stated that those alternatives presented in the report are adequate to provide the various levels of protection noted in the document.

- Fish and Wildlife Service

By letter dated 3 May 1978, the Fish and Wildlife Service (FWS) mentioned its detailed report on the impacts of the project on fish and wildlife will soon be completed. FWS stated its full support for establishment of a National Wildlife Refuge in the Cache Creek Settling Basin. (Their detailed report has been completed and is included in Appendix 6.)

- Geological Survey

By letter dated 11 April 1978, the Geological Survey stated that it would be useful to include more specific information in the report concerning gravel excavation in Cache Creek channel. Although a great deal of additional specific information regarding gravel extraction has not been added to the report, an August 1976 report prepared by Woodward-Clyde Consultants for the Yolo County Planning Department may be useful. The report is entitled "Aggregate Extraction in Yolo County — A Study of Impacts and Management Alternatives."

- Heritage Conservation and Recreation Service

By letter dated 19 April 1978, the Heritage Conservation and Recreation Service stated the EIS adequately discusses impacts on recreation resources in the project area. Proposed improvements should substantially improve the quality and availability of passive and consumptive recreation opportunities and environmental education with only minor and temporary disturbances to existing recreation resources.

- National Park Service

By letter dated 4 April 1978, the National Park Service mentioned that additional information regarding cultural resources coordination and studies should be included in the final EIS. Such information has been included in the final EIS.

- Department of Transportation

By letter dated 1 June 1978, the Department of Transportation noted that construction of new highway bridges near Clear Lake would not be eligible for Federal-aid highway funding and mentioned that it was verbally informed by the California Department of Transportation that construction of the new bridges was believed to be a Corps responsibility. The non-Federal sponsor of the project in upper Cache Creek Basin will pay for construction of the two new highway structures as a local cooperation requirement.

- Environmental Protection Agency

By letter dated 10 May 1978, the Environmental Protection Agency stated it had no objections to the proposed plan but believed additional information relative to air and water quality should be included in the EIS to allow the reviewer to fully assess the environmental impact of the project. Additional information requested has been incorporated into the final feasibility report and EIS.

Executive Order 11988

The objective of Executive Order 11988, Flood Plain Management, is to avoid to the extent possible the adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of flood plain development wherever there is a practicable alternative. Federal agencies are required to provide leadership and take action toward the fulfillment of that objective. The following considerations relate the recommended plan for Cache Creek Basin to the requirements of Executive Order 11988:

- The flood plain directly affected by the recommended plan (upper basin) is on the rim of Clear Lake. It will continue to be flooded with the proposed plan, but on a less frequent basis. The selected plan specifically embraces the objective of the Executive Order by requiring that future development meet existing requirements to flood proof or otherwise construct above the elevation of the preproject 100-year flood plain of Clear Lake. This requirement of local

cooperation will not induce damageable development in the base flood plain. Developments proposed within the Cache Creek Settling Basin (lower basin) are consistent with flood control and sediment control purposes of the basin and will have no impact on the base flood plain.

- All structural alternatives addressing the flood problem would have some impact on the flood plain of Clear Lake except the No Action plan. The consequences of taking no action would include a continuation of flood damages estimated to exceed $1.3 million annually, continued flood-related hazards to life and health, and a continuation of temporary disruptions during periods of high water. Nonstructural alternatives were also considered. The only economically feasible nonstructural alternative involved flood proofing future development to the SPF level. This feature was incorporated into the proposed plan by requiring future development to build to the elevation of the preproject 100-year flood, thus providing a greater degree of protection.

- The County of Lake has a zoning ordinance requiring future development to construct at or above the elevation of the 100-year flood plain. This ordinance will remain in effect with construction of the proposed plan of improvement.

- The natural values of the Clear Lake flood plain have been altered historically by development. The recommended plan will not induce additional development in the flood plain and will provide additional protection to development currently located there.

- No development will be induced in the flood plain regardless of the level of flood protection provided since future development will be required to construct above the elevation of the preproject 100-year flood. The recommended plan is the economically optimized plan.

- Others involved in this study include the County of Lake, U.S. Fish and Wildlife Service, State of California, local residents of the flood plain, and other environmental concerns such as the Sierra Club and Audubon Society.

Summary

Cache Creek Basin lies on the eastern slope of the Coast Range adjacent to the Eel River, Stony Creek, and Putah Creek Basins. The basin drains 1,150 square miles, including portions of Colusa, Lake, and Yolo Counties, and is naturally divided into two areas: the Clear Lake area, including tributaries to the lake, and the Cache Creek area, comprised of Cache Creek and its tributaries. The climate of the area is characterized by warm, dry summers with temperatures frequently exceeding 100 degrees and mild winters with temperatures seldom falling below freezing. The average annual precipitation, mostly falling between October and April, varies from 17 to 60 inches from the lower to the upper reaches of the basin and averages about 32 inches. Lake County, with a 1976 population of 27,600, ranks 41st in the State of California. Yolo County, with a 1976 population of 104,700, ranks 28th in California.

The major water resource related problem in the upper Cache Creek Basin is flooding on Clear Lake rim caused primarily by inadequate discharge capability of the lake's 5-mile-long outlet channel which discharges a maximum of about 8,000 cfs at extreme flood stage. Since historical flood inflows to the lake have at times exceeded 40,000 cfs, floodwater must be stored temporarily in the lake, thereby causing flooding along the shoreline. The most recent significant flooding occurred in 1958 and 1970. Damages incurred during the 1958 flood amounted to nearly $900,000 in 1958 prices. Damages in 1970 amounted to just under $500,000 in 1970 prices. The major water resource related problem in the lower basin is the large volume of sediment, which is transported by Cache Creek downstream to the Cache Creek Settling Basin. This basin was constructed in 1937 as a unit of the Sacramento River Flood Control Project to maintain floodflow capacity in the Yolo Bypass by controlling sediment inflow to the bypass. However, the storage capacity of the settling basin is now essentially exhausted, and sedimentation from Cache Creek has again become a problem. Cache Creek's heavy sediment load, about 675 acre-feet annually, is being carried into the Yolo Bypass, thus affecting the floodflow capacity of that unit of the Sacramento River Flood Control Project. Also, additional sediment flowing downstream compounds deposition problems in flood control and navigation channels such as the bypass, the Sacramento River Deep Water Ship Channel, and the San Francisco Bay system.

The plan selected to help alleviate flooding on Clear Lake rim includes widening and/or deepening 3.3 miles of the existing 5-mile-long Clear Lake Outlet Channel. Also, a 1.1-mile-long bypass channel would be constructed around the highly developed portion of the existing channel. The enlarged channel and bypass would conjunctively convey 8,000 cfs at a Clear Lake stage of 7.56 feet on the Rumsey gage at Lakeport. Also, future development would be required to flood proof or otherwise construct above the elevation of the preproject 100-year flood plane. The Gopcevic and Bemmerly Decrees would require some modification in order to

implement this plan. The total first cost of this plan for the upper basin would be $6,050,000. The total average annual cost including interest, amortization, operation, and maintenance would be $413,000. With average annual monetary benefits of $1,205,900, consisting of flood damage reduction and NED employment benefits, the benefit-cost ratio of this portion of the project is 2.9 to 1.

The plan selected to best achieve the proper degree of sediment control in lower Cache Creek Basin consists of enlarging and raising the existing perimeter levees of the Cache Creek Settling Basin an average of 12 feet to provide 50 years of sediment storage capacity and enlarging existing levees of the settling basin upstream to County Road 102. The Cobble Weir would also be reconstructed and enlarged. The existing training levees would be degraded and rebuilt adjacent to the western perimeter levee. Also, the entire 3,600 acres within the basin would be purchased in fee, and a National Wildlife Refuge would be established. In addition, 50,000 cubic yards of sediment would annually be excavated for use as topsoil or other agricultural benefit. The total first cost of this portion of the project is $11,910,000. The total average annual cost is $966,000 which includes interest, amortization, and operation and maintenance. With average annual benefits totaling $1,966,000, consisting of flood damage reduction benefits, sediment control benefits, wildlife enhancement, and NED employment benefits, this portion of the project provides a benefit-cost ratio of 2.0 to 1. Following authorization and post-authorization studies, and with adequate funding availability, it is estimated that both portions of the project could be constructed in 2 years.

With construction of the project in upper Cache Creek Basin, 79 acres, composed of grassland and several acres of riparian vegetation, would be affected. Temporary spoil area easements would total 80 acres. Two new bridges would be constructed over the bypass channel at State Highway 53 and old Highway 53. Numerous utilities would also have to be relocated. Channel excavation would require relocation of several residences and docks along the existing channel. In the lower portion of the basin, the entire 3,600 acres of the settling basin would be purchased in fee. This would require removing three dwellings in the northern portion of the settling basin and providing relocation assistance to the residents. Since levee enlargements would be on the waterside of the existing levee, no additional rights-of-way would be required beyond those currently held by the State of California. After construction, all scarred areas, including new levees and borrow areas, would be planted with native vegetation. In the upper portion of the Cache Creek Basin, the Federal Government would design and construct the project. Based on the President's proposed cost-sharing criteria, the total Federal first cost is estimated at $3,740,000. The non-Federal share of the total first cost of this portion of the project is estimated at $2,310,000. Non-Federal interests would also operate, maintain, and provide replacements for all project features at an estimated average annual cost of $11,400. They would be required to provide all lands, easements, and rights-of-way, hold and save the United States free from damages due to construction and operation of the project, adjust all claims regarding water rights that might be affected by flood control improvements, and require future development on Clear Lake rim to build above or otherwise flood proof to the elevation of the

preproject 100-year flood plane. In the lower portion of the basin, the Federal Government would design and construct the project. Based on the President's proposed cost-sharing criteria, the Federal share of this portion of the project is estimated at $9,215,000. This includes $1,340,000 for wildlife enhancement, a portion of which is for lands that can be attributed to this project purpose. The non-Federal share of the total first cost of this portion of the project is $2,695,000. This includes $1.8 million for that portion of settling basin lands which can be attributed to sediment control. Non-Federal interests would also operate and maintain the sediment control portion of the project in a manner compatible with wildlife enhancement and management at an average annual cost of $19,100. They would also provide all easements and rights-of-way necessary for construction of the sediment control project. They would hold and save the United States free from damages due to construction and operation of the project, except for those due to the fault or negligence of the United States or its contractors; adjust all claims regarding water rights that might be affected by the project; and over the 50-year project life, remove a quantity of sediment from the Cache Creek Settling Basin equivalent to at least 50,000 cubic yards per year. The U.S. Fish and Wildlife Service would operate and manage the National Wildlife Refuge in a manner compatible with sediment control at an average annual cost of $125,000.

Conclusions

The District Engineer, Sacramento District Corps of Engineers, has reviewed and evaluated, in light of the overall public interest, the information contained in the environmental statement, other documents concerning the Cache Creek Basin, and views of other agencies, organizations, and individuals on environmental and other impacts of the plans for improvement of Cache Creek Basin. The District Engineer concurs in the recommendations of the U.S. Fish and Wildlife Service as set forth in the 1 August 1978 letter transmitting their Detailed Report. In addition, the District Engineer has personally inspected the project area and has participated in meetings with local Government officials, representatives of other agencies and organizations, and landowners and other concerned members of the public.

The possible consequences of enlarging the Clear Lake Outlet Channel and raising the perimeter levees of the existing Cache Creek Settling Basin and establishing a wildlife refuge were studied and evaluated for environmental effects, social well-being, engineering considerations, and economic factors. Specific attention was given to alleviating flood damages in the upper portions of Cache Creek Basin and controlling sediment in the lower basin, providing wildlife enhancement opportunities for lower Cache Creek Basin, and preserving natural esthetics of the area.

In conclusion, it has been found that the action proposed is based on a thorough evaluation of all viable alternatives. The project is in consonance with national policy, existing statutes, and administrative directives. Further, construction of the proposed project is supported by the State of California and Flood Control and Water Conservation Districts of Yolo and Lake Counties. The environmental statement meets or exceeds the requirements of the National Environmental Policy Act. The project will assist in promoting productive and enjoyable harmony between man and his environment.

Recommendations

It is recommended that modifications to the Clear Lake Outlet Channel in upper Cache Creek Basin and modification of the Cache Creek Settling Basin and creation of a National

Wildlife Refuge in lower Cache Creek Basin, described as the selected plans in this report, be authorized for Federal construction, with such modifications as in the discretion of the Chief of Engineers may be advisable, at a currently estimated Federal first cost of $13,753,000, provided that non-Federal interests will:

- Contribute a 5 percent cash share of the total first cost of the project, to be paid concurrently, and proportionately with the Federal contractual obligation for project construction.

- Provide all lands, easements, and rights-of-ways necessary for construction and maintenance of the flood damage reduction measures, including all relocations and alterations of buildings, roads, highways, bridges, sewers, and utilities (except for the settling basin lands which will be acquired in-fee by the Federal Government; non-Federal interests will be required to reimburse that portion of this cost attributable to those settling basin lands required for sediment control). Should the cost of lands, easements, rights-of-ways, and relocations exceed 20 percent of the cost of flood damage reduction measures, the Federal Government would reimburse local interests for all costs in excess of 20 percent.

- Pay or contribute in kind that portion of the cost of flood damage reduction measures which, when added to the cost of lands, easements, rights-of-way, and relocation, would amount to 20 percent of the cost of flood damage reduction measures.

- Maintain, operate, and replace project facilities after completion of the project in accordance with regulations prescribed by the Secretary of the Army, except for the wildlife refuge, and conduct sediment control operations in a manner compatible with wildlife enhancement.

- Hold and save the United States free from damages due to the construction and operation of the project, except for damages due to the fault or negligence of the United States or its contractors.

- Adjust all claims regarding water rights that might be affected by the project.

- Require future development on Clear Lake rim to build above or otherwise flood proof to the elevation specified under the National Flood Insurance Program. The specified elevation will be that in effect just prior to construction of the project.

- Over the 50-year project life of the Cache Creek Settling Basin, remove a quantity of sediment equivalent to at least 50,000 cubic yards per year.

Donald M. O'Shei

DONALD M. O'SHEI
Colonel, CE
District Engineer

water diversions are low or absent. This flow pattern precludes the occurrence of much fish life in Cache Creek below Capay. Some fish may occur in isolated pools and irrigation laterals throughout the year downstream from Capay. A list is available in the Sacramento District of fish species which might be expected to occur downstream of Clear Lake Dam.

24. Wildlife species are described separately for the two subbasin areas. In the Clear Lake Outlet Channel area, Cache Creek from Anderson Marsh to Clear Lake Dam supports a diverse and varied array of wildlife. This is particularly true of the Anderson Marsh area. Mammals commonly found in this area are blacktailed deer, muskrat, raccoon, fox, and grey squirrel. Commonly observed birds include western grebe, blackbirds, herons, egrets, bitterns, valley quail, and mourning dove. Various species of reptiles and amphibians are also present. Lists are available in the Sacramento District of bird species and reptile, amphibian, and mammal species occurring in the area.

25. In the lower Cache Creek area wildlife species are, for the most part, those associated with irrigated agricultural land and riparian habitat. Blacktail jackrabbits and ground squirrels are common mammals. Pheasants, valley quail, mourning dove, and numerous species of waterfowl and songbirds are frequently observed. Lower Cache Creek and the Cache Creek Settling Basin are within the Pacific Flyway.

Approximately 10 to 12 million ducks and geese, accompanied by hundreds of thousands of shorebirds and other related avifauna, annually winter or pass through the Central Valley of California. Approximately 300,000 ducks and geese winter in the Yolo Bypass area (including Cache Creek Settling Basin). The Central Valley of California originally contained about 4 million acres of wetlands. To date, approximately 96 percent of these have been destroyed. This destruction has caused a shortage of wintering habitat relative to the existing amount of breeding habitat in northern portions of the continent, and the U. S. Fish and Wildlife Service has determined that the imbalance has reached a point where wintering habitat may be limiting some Pacific Flyway populations. Lists of bird species and of reptile, amphibian, and mammal species occurring in the area are available in the Sacramento District.

Rare and Endangered Species

26. Table B-2 identifies those wildlife species whose distributions include the Clear Lake and Cache Creek areas and which are found on the Federal and State rare and endangered species lists. The Southern bald eagle, American peregrine falcon, and California yellow-billed cuckoo are wildlife species whose distributions include the Clear Lake and Cache Creek areas and which are found on the Federal and State rare and endangered species lists; however, it should be noted that inclusion of species on these lists does not positively indicate their presence at this time within the project area but rather acknowledges their possible presence based upon the distributional characteristics of each species.

27. The Southern bald eagle and American peregrine falcon may be found associated with the grassland and riparian habitats of the project area, occurring only as casual visitors. The California yellow-billed cuckoo, which nests in dense riparian habitat in California from May until September and winters in South America, has been observed in the riparian areas associated with Cache Creek and Clear Lake.

28. Table B-3 identifies those plant species whose distributions include the outlet channel, Cache Creek, and settling basin areas and which are found on the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California. Table B-3 also identifies the Native Plant Society's inventoried natural areas

PROBLEMS AND NEEDS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

RECENT FLOOD DAMAGES

30. In February, March, and April 1958, the elevation of Clear Lake reached a maximum of 10.88 feet on the Rumsey gage at Lakeport and exceeded 9.0 feet for 44 days. During all this time the maximum possible release was being made from the lake. In 1958, about 4,000 acres of residential, commercial, and agricultural lands were flooded to a depth of about 2 feet, and water remained in many homes and business establishments for as long as 2 months. The flood of 1958 caused damages estimated at $878,000 in areas adjacent to Clear Lake. In January 1970, Clear Lake reached a stage of 10.47 on the Rumsey gage. About 1,600 acres were flooded around the rim, and damages amounted to $485,000. Table C-6 summarizes the damages reported from these two floods.

Table C-6
Clear Lake Flood Damages
1958 and 1970

Category	1958 Flood ($1,000)	1970 Flood ($1,000)
Residential	440	186
Commercial	312	125
Public Facility	74	115
Agricultural	52	59
Total	878	485
Total in 1977 prices*	2,148	828

* The updated 1977 values represent a change in price levels only. The consumer price index for shelter was used to update damages for the residential category; commercial, industrial, and public facility damages were selected by applying the Department of Commerce composite construction index. Values for agricultural properties were increased in relation to prices paid by farmers.

31. Before the design capacity of the Cache Creek levees downstream of Yolo was increased from 20,000 to 30,000 cfs in 1961, a levee break in this area occurred in February 1956, causing 700 acres to be flooded. In February 1958 the levees successfully held a peak flow of 41,400 cfs. However, the levees were under constant surveillance, and critical areas were sandbagged to prevent major flooding. At the same time, Cache Creek overflowed its banks upstream from the levees, flooding farmlands and roads. Flood damage along the lower reaches of Cache Creek during the 1958 flood was estimated to be about $520,000, as summarized in the following table:

Table C-7
Cache Creek Flood Damages
1958

Category	Damages ($1,000)
Residential	5
Commercial	5
Industrial and utilities	10
Public facilities	276
Agricultural	221
Total	517
Total in 1977 prices*	1,299

* The updated 1977 values represent a change in price levels only. The consumer price index for shelter was used to update damages for the residential category; commercial, industrial, and public facility damages were selected by applying the Department of Commerce composite construction index. Values for agricultural properties were increased in relation to prices paid by farmers.

In 1970, limited flooding in the lower basin adjacent to Cache Creek caused approximately $50,000 ($96,000 in 1977 prices) in agricultural damages, primarily.

alfalfa, are produced on land that is level and fertile enough for such use. Some lands are used for pasture. The following chart tabulates the number of acres for selected flood plains described in this analysis.

Clear Lake Rim
Crop Distribution for Selected Frequencies

	SPF	100-YR	50-YR	25-YR	10-YR
Orchards	805	590	390	200	50
Grain	495	485	470	450	400
Alfalfa	155	155	150	140	110
Pasture	785	765	680	600	550
Native	1,895	1,825	1,790	1,750	1,700
Total	4,135	3,820	3,480	3,140	2,810

37. Reach 1 extends through the Capay Valley from the town of Rumsey to just above Capay Diversion Dam. The creek in this reach flows through a gently rolling terrain comprised of land used predominantly for orchards and field crops with some native forage. Farm improvements, including residences and adjacent farm buildings, occupy approximately 15 of the 2,475 acres within this reach.

38. Reach 2 lies between Capay Weir and Airport Road (also called County Road 94B), located west of the town of Yolo in the Sacramento Valley. Farmsteads within the flood plain occupy approximately 10 acres, and an additional 10 acres is devoted to urban uses. The remainder of the land is used for agriculture. The major features of the terrain are those common to other wide-spreading alluvial fans, that

is, mainly flat but with a slight slope and somewhat deep soils with enough natural drainage to be good for crop production.

39. Reach 3 is downstream of Airport Road and terminates at the Cache Creek Settling Basin. About 98 percent of this flood plain is agricultural cropland, and 2 percent (about 185 acres) is urbanized land. Land in agricultural production is intensively used for crops varying from sugar beets to pasturage and orchard crops, including walnuts. The city of Woodland is adjacent to the flood plain with some

fringe areas being flooded infrequently by high flows from Cache Creek. This fringe area includes much of the industrial sector of Woodland. Terrain in Reach 3 on both the north bank and the south bank of Cache Creek is generally flat with deep sediment soils.

DETERMINATION OF FLOOD PLAINS

40. In reaches 1 through 3, flood plains were determined by routing floodflows down Cache Creek from Rumsey to the Cache Creek Settling Basin. HEC-2, Water Surface Profiles computer program, was used in the analysis. As input, field cross sections of the channel were obtained along the entire length of the channel and at all bridges. These cross sections were supplemented with stereo aerial photography, 7-1/2 minute USGS quadrangle maps, numerous field inspections, and field surveys made during and after historic floodflows.

41. Flood plains around Clear Lake rim were determined from a variety of information. Along the southeast portion of the lake, which includes the communities of Clearlake Park and Clearlake Highlands, and the Clear Lake Outlet Channel, aerial photography by the Lake County Sanitation District was utilized. This photography is to a contour interval of 2 feet, with numerous spot elevations. Along the northern portion of the lake, which includes the communities of Lucerne, Nice, and Lakeport, aerial photography by the Lake County Sanitation District again supplemented other available information. It included profiles of the

Table C-11

Clear Lake Rim Existing and
Projected Units Standard Project Flood Plain

	1977	1985	1995	2005	2015	2025	2035	-	2085
Residential Homes	800	1006	1151	1283	1453	1584	1677		1677
Mobile homes	245	305	353	393	445	471	471		471
Commercial	1651	1658	1688	1720	1772	1786	1798		1798
Private Piers	1324	1463	1580	1674	1778	1842	1842		1842
Agriculture (acres)	4135	4076	4035	3999	3954	3919	3900		3896

Table C-12

Existing and Projected
Crop Distribution and Yield
Clear Lake

	1977		2035	
Crop	Acres	Yield (Ton/acre)	Acres	Yield (Ton/acre)
Alfalfa	155	5.60	200	8.40
Grain	495	1.80	600	3.80
Pasture	785	8.70	900	11.0
Orchards	805	5.84	1200	11.4
Native Pasture	1895	-	1000	-
Total	4135		3900	

Source: 1977 estimates based on field surveys and Lake County Agricultural Crop Reports; 2035 projections adapted from California Framework Studies.

47. No significant increase in residential, commercial, or industrial units is projected for Reaches 1 and 2 during the study period. These reaches are located in a rural portion of Yolo County with predominantly agricultural land use. The Open Space Element of the Yolo County General Plan indicates a majority of this acreage is classified in agricultural preserve status under the California Land Conservation Act (Williamson Act) of 1965. The Sacramento Regional Area Planning Commission (SRAPC) Regional General Plan, Physical Development Element, August 1973, indicates that future urban development projected for this portion of Yolo County can be readily accommodated in existing rural communities such as Madison, Esparto, and Guinda in areas outside of the flood hazard area.

48. Future residential, commercial, and industrial development projected for Reach 3 is presented in table C-13. These projections were based on 1974 Department of Finance population projections modified by present trends to fewer persons per housing unit and the general growth patterns projected for urban development in the Woodland area presented in the SRAPC General Plan (page 21). In the Woodland area, residential and associated commercial development is expected to move in a southerly direction towards the city of Davis and away from the flood plain area. However, some residential development is expected in the northwestern portion of Woodland as current developments extend to areas

55. Residential content values for the flood plain areas are currently estimated at 35 percent of structural values. Increases in content values during the study period are projected on the basis of anticipated growth in the resident per capita income. Based on the per capita income projections previously presented for Lake and Yolo Counties, residential content values in the Clear Lake and Cache Creek areas are projected to increase at an average rate of 2.84 and 2.7 percent per annum, respectively, until content values reach a maximum of 75 percent of structural values. For both areas the 75 percent limit would be reached before the year 2005. Additional increases in residential content value are not projected beyond the 75 percent limit. The effect of the affluence factor on future residential content values is summarized in tables C-15 and C-16.

FLOOD DAMAGE

56. Average annual flood damages were computed for Clear Lake rim and lower Cache Creek area based on 1977 conditions. These data are presented in table C-17.

Table C-15

Clear Lake Rim - Residential

	1977	1985	1995	2005	2015	2025	2035	-	2085
Residential Structures 1/									
Number of units	800	1,006	1,151	1,283	1,453	1,584	1,677	-	1,677
Average value of structures ($1,000)2/	25.0	26.4	27.4	28.3	29.3	30.2	30.2	-	30.2
Without affluence									
Average value of contents ($1,000)	8.8	9.2	9.6	9.9	10.3	10.6	10.6	-	10.6
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents ($1,000)	8.8	11.9	15.9	20.1	20.8	21.4	21.4	-	21.4
Percent of structural value	35	45	58	71	71	71	71	-	71
Mobile Homes									
Number of units	245	305	353	393	445	471	471	-	471
Average value of structure ($1,000)2/	7.4	8.1	8.4	8.6	8.8	8.9	8.9	-	8.9
Without affluence									
Average value of contents ($1,000)	5.5	6.0	6.2	6.4	6.5	6.6	6.6	-	6.6
Percent of structural value	74	74	74	74	74	74	74	-	74
With affluence									
Average value of contents ($1,000)	5.5	6.0	6.2	6.4	6.5	6.6	6.6	-	6.6
Percent of structural value	74	74	74	74	74	74	74	-	74

1/ Excluding mobile homes.
2/ No increase in value is projected for existing units. New and replacement units are evaluated at average 1977 construction prices: $27,500 and $32,000 for conventional housing, $6,000 and $12,000 for mobile homes. Replacement is based on an average replacement cycle of 55 years for conventional housing and 30 years for mobile homes.

lake by early summer. For many years the hitch was considered one of the most important forage species for game fish in Clear Lake. However, currently the hitch is of relatively minor importance to game fish production or to the economy of the Clear Lake fishery.

89. The Clear Lake area is inhabitated by many species of wildlife including black-tail deer, ring-necked pheasant, mourning dove, valley quail, and rabbits. Waterfowl visit the area during migration periods. Fur-bearing animals include gray fox, bobcat, mink, raccoon, striped skunk, and muskrat. Many of these fur-bearers live along or in stream courses.

90. Cache Creek and its tributaries provide minor fisheries for smallmouth bass and white catfish. Other warmwater game species are present in limited numbers but contribute very little to the total sport catch. In addition, other nongame species, principally of the minnow family, squawfish, carp, and roach, are found throughout the drainage basin. Rainbow trout are present in the headwaters of North Fork of Cache Creek where water temperature is suitable year-round. In the Clear Lake Outlet Channel area, Cache Creek is considered by the State of California to be a Class II-very good waterway and Clear Lake a Class I-premium waterway for warmwater fisheries. The heavy sediment-carrying characteristic and intermittent nature of lower Cache Creek limit the production of game fish in the creek. Cache Creek is fed by many mineralized streams which further inhibit fishery productivity.

91. At the mouth of Cache Creek, the settling basin currently contains some lands that are not used for agriculture, thereby allowing maximum use for wildlife. However, that the amount of unused land has been continually diminishing concerns both the U.S. Fish and Wildlife Service and Department of Fish and Game. In addition, the U.S. Fish and Wildlife Service has determined that the Central Valley of California provides wetland habitat which is critically important for Pacific Flyway wintering waterfowl. The continued destruction of wetlands in California has caused a shortage of wintering habitat relative to the breeding habitat in northern portions of the continent so that wintering habitat may be limiting to some Pacific Flyway populations. The Fish and Wildlife Service's "Concept Plan for Waterfowl Wintering Habitat Preservation - Central Valley California" (1978) ranks the Yolo Bypass area (which includes the Cache Creek Settling Basin) second only to the Sacramento-San Joaquin Delta in priority for development of new wintering areas based on desirability, potential value, and feasibility of development.

General Recreation Needs

92. The Clear Lake area has been intensively developed for water-associated recreation. The lake has a shoreline of about 100 miles, of which 39 are presently developed for water-associated recreation facilities, including public and private beaches, wharfs, and lakeside residences.

93. Most of the desirable shoreline locations around Clear Lake have been developed with facilities; at Clear Lake Highlands, the shoreline is virtually saturated with recreation developments. Most of the shoreline areas having access to deep waters are developed to some extent. The largest areas of undeveloped shoreline exist southeast and northeast of Lakeport along shallow and marshy reaches of lakeshore where, during periods of low water, the lake recedes, leaving large

governmental and environmental concerns, including State and Federal wildlife agencies.

62. Local interests have indicated that channel enlargement alone is unacceptable because of the disruption of development along the outlet channel and the relatively high cost of relocations when compared to other alternatives. As noted in table 3, this plan provides identical flood control benefits to Plans 9 and 10; however, its first cost is about 2.1 million in excess of Plan 9, with a significant portion for lands and relocations. The U.S. Fish and Wildlife Service and the California Department of Fish and Game indicate that this plan will be more damaging to fish and wildlife than Plans 9 and 10. This alternative is subject to restrictions of the Gopcevic and Bemmerly Decrees, which were discussed in Section C and paragraph 14.

CLEAR LAKE OUTLET CHANNEL ENLARGEMENT AND BYPASS (PLAN 9)

63. This alternative, shown on plate D-4, is similar to the previously described plan in that it would involve alteration of the Clear Lake Outlet Channel to allow increased flows out of Clear Lake during flood periods. However, in order to lessen the impact of outlet channel modification on streamside development, a 1.1-mile bypass channel would be constructed around the developed portion of the channel. The remainder of the existing channel both upstream and downstream of the bypass channel (3.3 miles) would be enlarged, as in the previous plan. Various bypass

channel lengths were investigated; however, in complying with the desires of local interests, a minimum 1.1-mile-long bypass channel was developed as a part of this plan.

64. The bypass channel, as proposed, would have side slopes of 1/2 Horizontal (H) to 1 Vertical (V) through the portion underlain by rock and 2H to 1V through the portion of the reach with an earth base. It would have a weir at its upstream end and a control structure in the outlet channel adjacent to the weir to control flow into the bypass channel. The channel would be designed so that positive flow would be continuous through both the existing and bypass channels to preclude any stagnant water or entrapment of aquatic organisms. The two structures would also function to ensure design flows would be conveyed down both channels during flood periods. For instance, for a "system" flow of 8,000 cfs, the capacity which provided greatest net benefits, 2,000 cfs would be carried by the existing channel and 6,000 cfs by the bypass channel. Riparian species of trees and other vegetation would be planted along the bypass channel and in denuded areas of both channels to supplement native vegetation which would naturally reestablish. In addition, fish habitat improvement measures such as construction of potholes in the channel bottom would be included.

65. As with the previous alternative, construction would require relocation of numerous docks and 10 private residences. New structures would be required at State Highway 53 and old Highway 53.

66. With this plan, future development would be required to continue to build at or above Clear Lake stage of 11.85 feet, even though the proposed

note that settling basin lands would still be privately owned and operated for agricultural uses; there would be no provision for excavating sediment in excess of 50,000 cubic yards annually (even though 1.2 million cubic yards are annually carried by Cache Creek to the basin); and all easements would expire at the end of the 50-year project life.

b. The Department of Water Resources also estimates that fee purchase of the entire 3,600 acres of the Cache Creek Settling Basin would cost $2,650.000. This price of fee purchase is $850,000 greater than that necessary to acquire the necessary easements described in a. above. However, the following operational advantages would be offered by fee purchase of the basin as opposed to right-of-way acquisition.

(1) Fee ownership would preclude operation and maintenance problems which have historically occurred. For instance, legal decisions have prevented the State from manipulating the Cobble Weir or perimeter levees to increase or prolong sediment entrapment.

(2) Fee ownership would allow the State to dispose of deposited sediment as needed to prolong the life of the basin. As discussed in Section C, deposited sediments are excellent for uses such as topsoil and construction fill material. Such a plan for disposition of deposited sediment would be difficult to arrange for and administer without fee ownership. With this plan 50,000 cubic yards of sediment would be furnished annually for use by local topsoil distributors, in addition to

other demands for sediment that could be established during the life of the project.

(3) Fee purchase would allow the State to lease 2,950 acres from the 3,600-acre basin back to local farmers for continued use in agricultural production. Rental revenues of $60 per acre obtained would be used to offset expenses incurred by construction of the project. The net outlay by the State for this type of operation would be less than that incurred to pay for flowage easements, and much greater operational flexibility would be obtained.

(4) Fee purchase would allow operational advantages necessary to conjunctively operate the settling basin for sediment control and wildlife enhancement. The U.S. Fish and Wildlife Service has determined that sediment control and wildlife enhancement are compatible, but not without flexibility to operate the refuge in a manner most beneficial to wildlife. Proper wildlife management will require extensive use of existing wells; some areas will be in crop production, others will be flooded or otherwise sacrificed for wildlife. Crop sharing with tenants is another potential operational feature of the refuge. None of these aspects necessary to successful operation of a refuge would be possible without fee title to settling basin lands.

A plan involving easement purchase could materially control sediment. However, such a plan would not be practical or implementable due to operational constraints. For this reason, no alternative "without fee title" was fully developed as a means of solving sediment deposition problems in lower Cache Creek Basin. Plan 14, which calls for dual use of the settling basin for sediment control and wildlife enhancement, uses this information as a basis for cost allocation between the two purposes.

RAISE SETTLING BASIN LEVEES WITH WILDLIFE REFUGE (PLAN 14)

74. This alternative, as shown on plate D-6, is similar to the previous plan in that the existing settling basin would be used to control Cache Creek sediment. Identical with the previous plan, existing project levees would be raised to provide 50 years of storage capacity, the Cobble Weir would be reconstructed, training levees would be relocated, provisions would be made for furnishing 50,000 cubic yards of sediment per year for use as topsoil, and the 3,600 acres within the settling basin would be purchased in fee. However, rather than leasing the basin back to local farmers for agricultural use as in the previous plan, the entire 3,600 acres would be established as a National Wildlife Refuge. To optimize wildlife enhancement, two refuge sizes (2,300 and 3,600 acres) were investigated. Results of the investigations showed that the 3,600-acre refuge provided greater net wildlife enhancement benefits. In addition, State and Federal wildlife

agencies indicated the larger refuge would better serve the need for wildlife management in this portion of the Sacramento Basin. Particulars of refuge establishment, and requirements in coordinating refuge operation with the primary function of sediment control, are as follows:

a. The interior of the basin would be designed to accommodate the refuge and would consist of a system of levees about 3 feet high with 10-foot crown widths. In addition, for necessary water management in operation of the refuge, various canals and pumping facilities would be required to supplement those in existence.

b. Operation and maintenance requirements for the basin would be established such that, in the future, deposited sediment could be excavated to prolong the life of the basin for sediment entrapment. The U.S. Fish and Wildlife Service, by letter dated 5 January 1976, stated that excavation of sediment from the settling basin on a rotational basis ". . . lends itself to the establishment of a wildlife refuge as a compatible part of the project." The letter further stated that sediment excavation alternatives ". . . offer the best potential to meet the goals of fish and wildlife conservation, flood control, and sediment control."

75. On 20 January 1976 the U.S. Fish and Wildlife Service established a priority system for their Migratory Bird Land Acquisition Program. Thirty-three areas throughout the Nation were investigated, and the Central Valley of California ranked fourth in importance on the National priority list for wetland preservation and enhancement. In addition, the Central Valley habitat was ranked number one in importance within the Pacific Flyway. The Fish and Wildlife Service prepared a "Concept Plan for Waterfowl Habitat Preservation - Central Valley California" as part of the Migratory Bird Land Acquisition Program. The concept plan concluded that "Maintenance of current waterfowl population levels in this (Pacific) Flyway depends upon a vigorous effort to preserve and enhance existing wetlands as well as develop new areas in California's wintering grounds." In selecting potential new wetland development areas based on desirability, potential value, and feasibility, the report ranks the Yolo Bypass area (including the Cache Creek Settling Basin) second only to the Sacramento-San Joaquin Delta. A wildlife refuge, if created within the settling basin, would be a valuable addition to the system of refuges in the Sacramento Basin. The U.S. Fish and Wildlife Service and California Department of Fish and Game indicate that such a refuge would help meet their objectives for wetland preservation in the Central Valley of California and also for additional refuges for migratory birds. Also, by improving waterfowl distribution, disease loss and crop depredation would be decreased. In addition, recreational consumptive uses such as hunting and fishing, as well as nonconsumptive uses such as environmental education, would increase.

THE SELECTED PLANS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

damage reduction benefits are achieved over the 100-year life of the project and total $1,170,200. Area redevelopment benefits totaling $35,700 annually would accrue to the local population that would be unemployed without project construction and maintenance activities. The enlarged outlet channel will permit a slight revision to the manner in which Clear Lake is now filled, thus helping to provide a more reliable source of irrigation water for use in Yolo and Lake Counties.

4. Enlargement of the outlet channel would affect the magnitude and duration of downstream flows. Routing of historical and synthetic flood events indicates that the proposed project would slightly reduce peak flows of infrequent floods downstream of Clean Lake Dam. However, for floods occurring more frequently, the project would increase peak flows downstream since the enlarged outlet channel would provide the capability to release flows of greater magnitude than can be released under existing conditions and would maintain the duration of these flows for longer periods of time. These larger flows would not increase flooding downstream of Clear Lake Dam since releases are based upon and governed by the nondamaging flow of 20,000 cfs at the town of Rumsey.

A downstream erosion and sedimentation study was conducted utilizing mathematical models as tools in analyzing hydraulic, hydrologic, and sediment transport conditions on Cache Creek with the project. One of these tools was the computer program HEC-6, "Scour and

Deposition in Rivers and Reservoirs," developed at the U.S. Army Corps of Engineers' Hydrologic Engineering Center, Davis, California. This computer program is divided into three submodels which are described below:

a. Geometric Submodel.

This portion of the computer model is used to calculate hydraulic properties (at each cross section for each water discharge analyzed) for use in the sediment model. These hydraulic properties (depth, velocity, hydraulic radius, etc.) are calculated for each discharge by backwater computations similar to those in the HEC-2 program. Data requirements for this portion of the HEC-6 program include initial conditions of the creek's cross sections, reach lengths, and Manning's "n" values for water surface profile calculations. Cross sections (as well as HEC-2 water surface profiles) were available from a 1974 flood plain information study. The cross sections, spaced approximately 1 mile apart, extend from a point about 1-1/2 miles downstream of Rumsey to about 7 miles upstream of Capay, a distance of 14 miles. As the study reach extends from Rumsey to Capay, cross sections based on USGS topographic maps were added to the lower reach between Capay and the start of the surveyed cross sections. In addition, based upon experience gained in previous studies, it was felt that the 1-mile cross section spacing was too "coarse" to adequately

describe the channel geomorphology of the study reach. Thus, a one-half mile maximum spacing was adopted. The one-half mile spaced sections were developed either by "moving" adjacent surveyed sections or interpolating adjacent sections. Channel roughness or Manning's "n" values were calibrated by running the geometric model with two steady state flows, 10,000 and 21,000 cfs, to develop water surface profiles for comparison with data available from the 1974 Flood Plain Information Study. Right and left overbank "n" values of 0.050 and a main channel value of 0.040 were adopted as they produced water surface profiles consistent with those in the 1974 study.

b. Sediment Submodel.

This portion of the computer model calculates the sediment transport associated with the hydraulic properties at each cross section for each water discharge analyzed, as well as the bed gradation changes and scour or deposition. Data requirements for this portion of the HEC-6 program include grain size distribution of the material in the creekbed at each cross section, the gradation and amount of total inflowing sediment load as a function of water discharge, and the fluid and sediment properties. Thirteen bed and bank material (surface) samples were taken along the study reach. Based on these samples, "averaged" bed gradations were assigned to reaches of the creek. Sediment discharge data for Cache Creek above Rumsey for Water Years

1966-70 were obtained from USGS Water Quality Papers. These data included suspended load discharge and suspended load gradation data. Bedload discharge and gradation data were not available. However, based upon information in USGS Professional Paper 562-A, the bedload in Cache Creek was assumed to be 7 percent of the total sediment load. In addition, the inflowing bedload gradation was initially assumed to be the same as the bed material gradation near Rumsey. An average water temperature of 49°F (9.4°C) was specified on all model runs.

c. Hydrologic Submodel.

This portion of the computer model is used to describe the flow hydrograph on which sediment calculations are to be performed. The flow hydrograph is input as a flow histogram, a series of discrete flow events of a magnitude and duration such that the total sediment and water volume passed by the histogram is equal to that passed by the hydrograph it is simulating. Flood routings for 1952, 1956, 1958, 1965, and 1970 flood events for both preproject and project flow conditions were available. Other events of equally great magnitude have occurred but are of shorter duration.

A model of this complexity must be carefully calibrated if any measure of confidence is to be placed in the results. Passing of the

preproject hydrograph through the model provides a reasonable test of the performance of the model. First, no instability is present in the output. That is, there is no oscillation of the bed elevation or sediment transport at any point with time. In addition, passage of the discharge histograms for Water Years 1966-70 yielded a total sediment discharge near Rumsey within ± 25 percent of the measured USGS data, which is well within the accuracy of state of the art sediment transport calculations.

The preproject and project flow histograms for the five floods were passed through the computer model. No major differences in degree or location of scour or deposition zones were identified. Plate E-6A illustrates the effect of the selected plan on the 1958 flood season at selected locations in the Cache Creek Basin. As a further test, runs were made of synthetic "super floods," in which the five floods previously identified were routed "back-to-back," representing in excess of 350 successive days of high flow. However, as was shown in routing of the individual floods, the model results of the "super floods" indicate little or no difference in bed behavior between preproject and project flow conditons.

These results can be explained at least in part by noting the difference in flow relationship with and without the project. As pointed out on page C-45 of Appendix 1, at Yolo approximately 90

percent of Cache Creek's average annual bed material transport occurs between flows of 1,500 to 11,000 cfs. Table C-21 on that page identifies a significant increase in the bed material transport rate of the creek when flows exceed 2,000 to 3,000 cfs. During the flood of 1970, the number of days that the flow of Cache Creek at Rumsey exceeded 2,000 cfs would have been reduced from 47 to 27 with the project, a decrease of 43 percent. For the 1956, 1958, 1965, and 1970 floods, the average decrease in the number of "erosion days" where flows were decreased to less than 2,000 cfs with the project is 37 percent. In summary, the total volume of water for any particular storm runoff in Cache Creek is not changed with the project. A decrease of at least one-third in the number of days in which erosion will occur will be realized with the project and will reduce overall erosion. This benefit would, of course, be partially offset by increases in some peak flows.

Another tool used in this study to evaluate the effect the project would have on the downstream channel reach, particularly the streambanks, is a mathematical analysis technique developed by Dr. John F. Kennedy, Director, Institute of Hydraulic Research, University of Iowa. Dr. Kennedy proposed in a January 1978 ASCE Journal of the Hydraulics Division that by comparing the time-duration of shear stress exerted on the streams fluvial boundary for both preproject and project conditions, a measure of the potential for bank erosion could be obtained. The 1970 flood was analyzed. This flood produced a peak

discharge of 19,200 cfs with a total duration of 53.9 days under preproject conditions and a peak discharge of 17,200 cfs with a total duration of 40.6 days under project conditions. The analysis showed a 1.4 percent decrease in the time duration of shear stress with project conditions. This difference is small and probably not within the limits of computational accuracy but further verified that there will be no difference in the erosion characteristics of Cache Creek under preproject vs project flow conditions. However, sedimentation gages will be installed during advanced engineering and design studies to provide additional data for analysis.

In summary, studies have shown that the project will have an insignificant effect on the existing erosion problems currently experienced in and adjacent to Cache Creek channel downstream of Clear Lake Dam.

Effects of the Plan on the Environment

6. Primarily, the proposed plan would provide flood protection to homes, commercial developments, and agricultural crops encircling the Clear Lake rim, thus enhancing not only the quality of the human environment but the local economy as well. Although vegetation would be disturbed by enlargement of the existing channel, additional riparian vegetation would be planted, and new riparian vegetation would

be created along the banks of the 1.1-mile-long bypass channel and on denuded portions of the main channel. In addition, fish habitat measures such as construction of potholes in the channel bottom would be included. The U.S. Fish and Wildlife Service by letter dated 26 July 1977 stated that it did not foresee the need to recommend any land acquisition for mitigative purposes. It further stated that this position had been coordinated with the California Department of Fish and Game. Results of Fish and Wildlife Service studies also showed that the more rapid drawdown of Clear Lake during flood periods would have no effect on Anderson Marsh because the project only increases releases when Clear Lake is above a stage of 7.56 feet, which is several feet above the elevation at which water enters the marsh. A cultural resources reconnaissance report was completed in accordance with Corps of Engineers regulation, "Identification and Administration of Cultural Resources" (33 CFR 305). By letter dated 4 November 1977, the State Historic Preservation Officer stated he was impressed with the "professional quality" of the reconnaissance report. The environmental statement for this report is attached as Appendix 4. As required by the National Environmental Policy Act of 1969, the statement includes details of environmental, cultural, social, and economic effects of the selected plans. A summary of these effects is shown on Table 1, Section D, Summary of Economic-Environmental-Social Effects, Clear Lake Flood Control Alternative Plans. An analysis of the impact of the project on the base flood plain was made in accordance with Corps of

Engineers regulation, "Implementation of Executive Order 11988 of Flood Plain Management" (33 CFR 239). The selected plan requires that future development meet existing requirements to flood proof or otherwise construct above the elevation of the preproject 100-year flood plain. As a result, the project would not cause any change or provide direct or indirect support of development in the base flood plain, and therefore no further analysis under Executive Order 11988 is required. Similarly, developments within the Cache Creek Settling Basin are consistent with flood control and sediment control purposes of the basin and will have no impact on the base flood plain.

Design

HYDROLOGY

7. Standard Project Storms. - The general standard project rainstorm precipitation was computed in accordance with procedures outlined in the Sacramento District's preliminary "Standard Project Rain-Flood Criteria Report-Sacramento-San Joaquin Valleys," dated April 1971. Storm precipitation was assumed to occur as rain on snow-free ground. Two standard project storms, one centered over the drainage area above Indian Valley Reservoir and the other over Clear Lake, were selected from several centerings investigated, because the first produced the most critical flood in the lower Cache Creek Basin and the second produced the highest discharge from Clear Lake. Concurrent storm amounts were calculated for all other subareas for each storm

centering. Table E-1 shows data used in the development of standard project storms (SPS) and concurrent storms (CS) for each subarea.

8. Unit Hydrographs. - Synthetic unit hydrographs used for computing standard project floods are identical to those applied in reconstitutions of historical flood hydrographs in Cache Creek Basin. The development of these unit hydrographs is described in Section C, paragraph 18. Pertinent basin and unit hydrograph data are shown on table C-4. Sample unit hydrographs are shown on plates E-7 and E-8.

9. Losses. - Constant loss rates of 0.064, 0.04, and 0.030 inches per hour, derived from analyses of historical events in Cache Creek Basin, were adopted for North Fork Cache Creek, Cache Creek local above Rumsey and Bear Creek, and Cache Creek below Rumsey, respectively, and constant loss rates ranging from 0.045 to 0.061 inches per hour were used in various areas above Clear Lake Dam for standard project rain flood computations. The minor changes in land use from present conditions and those projected for the year 2020 were found to have little significant effect upon the overall loss rates.

10. Base flow. - Base flow for standard project floods in Cache Creek Basin was determined to be equivalent to or greater than that observed

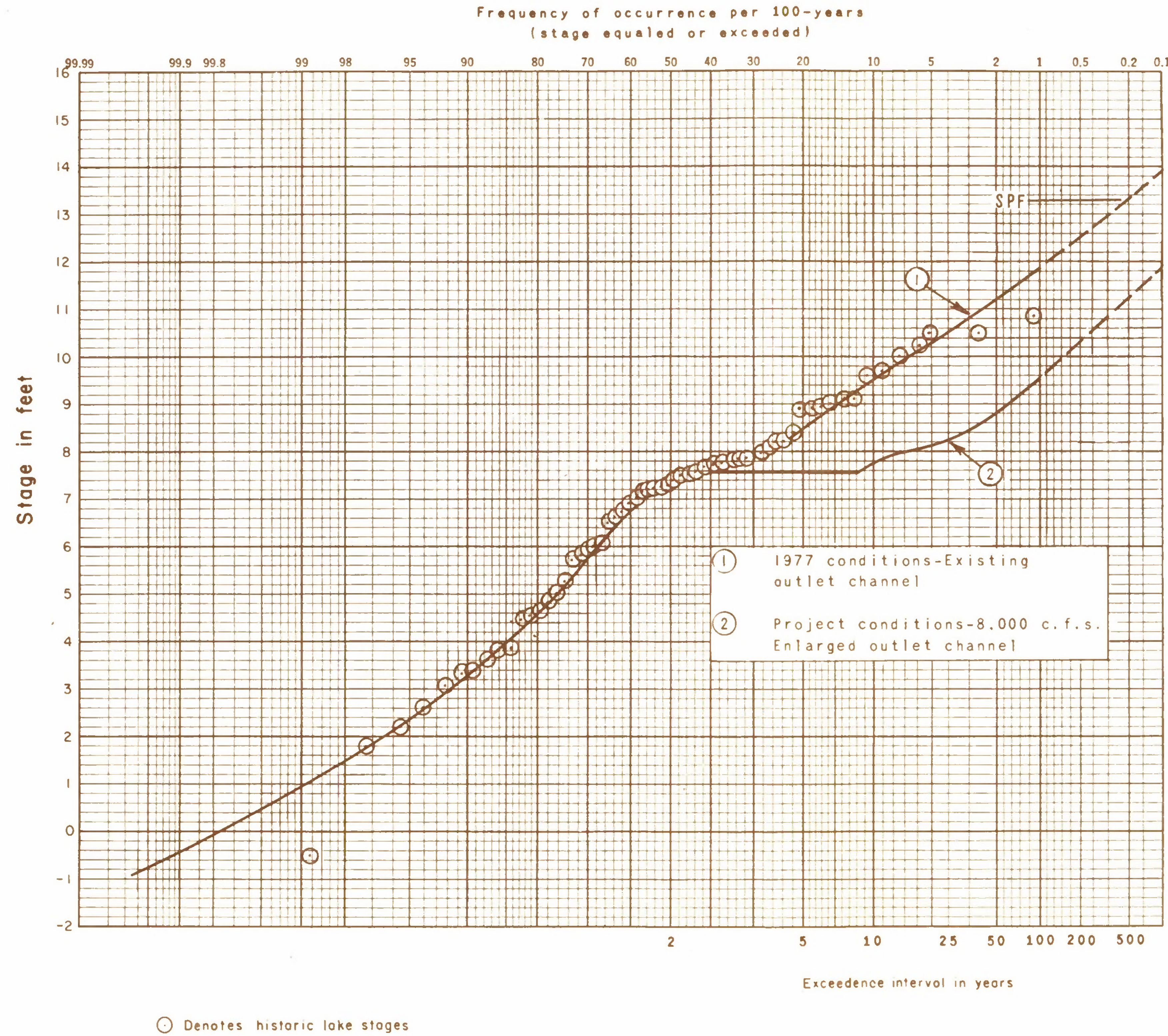
e. Excavating 50,000 cubic yards of sediment annually for use by local topsoil distributors.

Plan Accomplishments

22. The major accomplishment of this plan would be entrapment of an average of 340 acre-feet of Cache Creek's heavy sediment load upstream of the Yolo Bypass over 50 years. Without this control, 15 percent of the total sediment load entering the settling basin, or about 100 acre-feet each year, is expected to deposit within the Yolo Bypass adjacent to the Cobble Weir. Although this deposition would not significantly decrease the agricultural productivity of about 2,100 acres of agricultural land in the bypass over which the sediment would deposit, it would inundate and render useless 435 acres of industrial sewage oxidation ponds owned by the city of Woodland and would cause a backwater effect which would encroach on the freeboard of the Yolo Bypass levees from Interstate 5 north to the Fremont Weir; on the Sacramento River levees from the Fremont Weir downstream to the Sacramento Weir; and on the Knights Landing Ridge Cut levees for their entire 6.8-mile length. The remaining 85 percent of the total sediment load from Cache Creek would continue downstream in the Yolo Bypass where portions would eventually deposit in the Sacramento River, the Sacramento River Deep Water Ship Channel, and the San Francisco Bay System and require periodic dredging. Other accomplishments of this plan are discussed below.

23. A National Wildlife Refuge within the settling basin, operated by the U.S. Fish and Wildlife Service, would be a valuable addition to the system of refuges in the Sacramento Basin. The U.S. Fish and Wildlife Service and California Department of Fish and Game indicate that such a refuge would help meet their objectives for wetland preservation in the Central Valley of California and also for additional refuges for migratory birds as described in Appendix 1, D-52. Also, by improving waterfowl distribution, disease loss and crop depredation would be decreased. In addition, recreational consumptive uses such as hunting and fishing, as well as nonconsumptive uses such as environmental education, would increase. Some agricultural productivity on the 3,600 acres would continue but would be constrained by sediment and removal, refuge operation, and by the fact that only certain crops would be grown and a portion of these would have to be left for wildlife.

24. Provision for excavation of 50,000 cubic yards annually for use as topsoil would decrease storage requirements within the basin by about 1,550 acre-feet over the 50-year project life. This soil would serve as a source for the dwindling supply of this material in the Sacramento area. A study conducted by the University of California at Davis in November 1975, entitled "Cache Creek Basin Investigation, Cache Creek Settling Basin," established the demand of 50,000 cubic yards annually. Uses would be horticultural, such as landscaping. Material would be moved in small quantities (a truckload or two at a time) in a manner typical of topsoil sales in the Sacramento-Yolo County area.



CLEAR LAKE WAS OPERATED AS FOLLOWS:

a. Release project channel capacity when the flow at Rumsey is forecasted to be less than 20,000 cfs.

b. Release pre-project channel capacity when the flow at Rumsey is forecasted to be greater than 20,000 cfs.

CACHE CREEK BASIN, CALIFORNIA

CLEAR LAKE STAGE FREQUENCY

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977
Rev. 15 MARCH 1980

ECONOMICS OF THE SELECTED PLANS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

TABLE OF CONTENTS (Cont'd)

LIST OF PLATES

12. Public facilities damages include tangible damages resulting from inundation of public roads and bridges, streets, sidewalks, highway structures, parks, and other facilities, including equipment and furnishings owned or operated by Federal, State, County, or local governmental units.

13. Other losses to the public include the additional costs incurred during flood emergencies such as evacuation and reoccupation, flood fighting, disaster relief, and extra duty for police, fire, and military units.

14. Agricultural damages include inundation losses to crops, agricultural machinery, fences, wells, and farm buildings. Also included are such other intangible damages as costs of emergency actions.

DEPTH-DAMAGE RELATIONSHIPS

15. Depth-damage relationships describe the probable damages that will occur under different depths of flooding, either as a percentage of the total value of damageable property or in the probable loss expected. In addition to the depth of inundation, other variables which may have a significant impact on the economic damages sustained include the velocity of the water, duration of flooding, and wind-set. Under differing conditions of inundation, these variables will change in

relative importance. Depth of inundation and velocity are major variables governing damages occurring in the lower, Yolo County reaches, while depth of inundation, wind-set, and duration govern damages which would occur to properties along the rim of Clear Lake in any given event.

BUILDINGS, CONTENTS, AND PIERS

16. The depth-damage relationships for buildings, contents, and piers used in this analysis are presented in table F-5. These depth-damage relationships were derived from historic flood surveys and interviews with local officials.

Table F-5

DEPTH DAMAGE

Damage Category	Depth of Flooding From First Floor in Feet: -1.0	0.1	1.0	2.0	3.0
	Percent Damages				
Clear Lake Rim Reach					
Residential structures	0.0	12.0	28.0	39.0	45.0
Residential contents	0.0	12.0	46.0	65.0	78.0
Mobile home structures	0.0	15.0	66.0	89.0	92.0
Mobile home contents	0.0	7.0	39.0	73.0	89.0
Commercial structures	0.0	12.0	28.0	39.0	45.0
Commercial contents	0.0	12.0	46.0	65.0	78.0
Piers	0.0	2.0	16.0	25.0	52.0
Marina gas facility structures	0.0	0.0	6.0	15.0	31.0
Marina gas facility contents	0.0	0.0	7.0	23.0	40.0

Source: Piers and marina facilities developed from interviews of local marina operators. Remaining categories based on local interviews and historic surveys.

PUBLIC FACILITIES

17. Depth-damage relationships for public facilities such as roads and bridges and for emergency costs are derived from historical survey data and interviews with local officials. Total damage relationships associated with a given hypothetical level of flooding (see following discussion on flow- and stage-damage relationships) are developed for these damage categories rather than specific depth-damage relationships.

AGRICULTURE

18. Agricultural damage relationships are also developed for given hypothetical flood events on the basis of historical flood data from the study and similar areas. Both crop and noncrop damages are estimated. Noncrop damages include debris cleanup and leveling, and damages to improvements such as roads, fences, irrigation systems, and equipment that could not be removed prior to flooding. Noncrop damages are more dependent on the level of improvements common to the area than the particular crops planted.

19. Noncrop damages for improved acreage in the Clear Lake Rim Reach are estimated to average $115, $140, and $165 per acre, respectively, from flooding from the 50-year, 100-year and SPF events. Noncrop damages to native pasture are estimated to average $14 per acre in this reach. Values for noncrop losses were based on recent historic damages in similar developed agricultural areas. Figures were adapted from the 1970 Coalinga Stream study and the 1972 Andrus Island flood as well as from local farm estimates.

20. In determining average crop damages, consideration is given to planting times and probable timing of flooding as well as the impact of duration and velocity on crop yields. For example, the primary grain crop in the Clear Lake rim area is barley, which is normally planted in late fall or early winter. The expected flooding of agricultural areas from high lake levels would primarily occur in late winter or early spring, after planting had occurred. During a 50-year flood event, the lake level would be expected to exceed 9.0 feet at the Rumsey gage at Lakeport (1327.65 feet, m.s.l. datum) for more than 45 days. Such long-term duration of flooding would be expected to result in complete loss of the barley crop; and the average crop damage, would, therefore, be the gross return per acre less any cultural costs that would no longer be incurred. The 1974 normalized yield for dry-farmed barley in Lake County was 1.4 tons per acre, and the 1974 normalized price was $55.36 per ton for a gross return of approximately $78 per acre. Harvesting costs of approximately $9 per acre, based on a University of California Extension Service Study, "Sample Costs of Production," would be the only cultural cost that the farm operator would have not already incurred. Therefore, the average crop damage to barley would be $78 minus $9, or $69 per acre. Similar analyses were used to determine the remaining average crop damages within the study area.

Table F-6 below summarizes the average crop and noncrop damages for selected frequencies in the Clear Lake flood plain.

TABLE F-6

Agricultural Damages in Dollars Per Acre
Clear Lake Rim

	50-YEAR		100-YEAR		SPF	
	CROP	NONCROP	CROP	NONCROP	CROP	NONCROP
Orchards	342	105	369	129	445	152
Alfalfa	166 1/	105	166 1/	129	166 1/	152
Grain	69	105	69	129	69	152
Native Vegetation	Neg	13	Neg	13	Neg	13
Pasture	111 1/	105	111 1/	129	111 1/	152

1/Includes one-half of the cost for reestablishing stand.

STAGE-DAMAGE AND FLOW-DAMAGE RELATIONSHIPS

21. Stage-damage and flow-damage relationships describe the probable flood damages expected under varying stage elevations (Clear Lake rim). They are derived by estimating the probable flood damages for several hypothetical floods of given stage elevations. Intermediate damage points are interpolated from these estimates on the basis of the proportionate change in stage elevation.

22. The probable flood damages for the hypothetical floods are estimated by identifying the associated flood plain area, inventorying this area by damage category and depth of flooding, and applying the appropriate depth-damage relationship. Probable damages for the 25-year, 50-year, 100-year, and SPF flood events under existing conditions are summarized in table F-7 for the study area.

STAGE- AND FLOW-FREQUENCY RELATIONSHIPS

23. Stage- and flow-frequency relationships describe the probable frequency of occurrence of varying stage elevations or streamflows. These relationships are estimated for both with and without project conditions under present and future hydrologic conditions. The stage frequency relationships used in this analysis are presented in plate E-10. Plates F-6, F-7, and F-8 show the extent of the 100-year and SPF flood plains in the Lake, Lucerne, Clearlake Highlands, and Clearlake Park Areas.

Table F-7

CLEAR LAKE RIM
PROBABLE 25-YEAR, 50-YEAR, 100-YEAR, AND
STANDARD PROJECT FLOOD DAMAGES 1977 CONDITIONS
AND PRICES
(In Thousands)

Damage Category	25-Year	50-Year	100-Year	SPF
Residential structures 1/	$2,633	$ 3,997	$ 5,929	$ 8,146
Residential contents 1/	1,399	2,175	3,265	4,555
Mobile home structures	255	517	1,000	1,462
Mobile home contents	126	262	539	883
Commercial	2,861	3,863	5,185	6,654
Public facilities	185	246	424	708
Private piers	222	340	499	723
Agriculture	398	563	743	921
Emergency costs	29	43	71	91
Total	$8,108	$12,006	$17,655	$24,143

1/ Excluding mobile homes.

ECONOMIC SENSITIVITY ANALYSIS OF WAVE RUNUP AND WIND SETUP

37. All calculations and tabulations of damages and benefits in this report are based on a 1-foot average wave runup and wind setup. As discussed in Section C, a sensitivity analysis was made for various other levels of wave runup and wind setup. The following tabulation shows average annual equivalent preproject and residual damages and project benefits for wave runup and wind setup of 0.5, 1.0, and 1.5 feet.

SENSITIVITY EFFECT OF WIND SETUP AND WAVE RUNUP

	Height		
	0.5 feet	1.0 feet	1.5 feet
Preproject Damages 1/	827,900	1,349,700	1,534,700
Residual Damages 1/	98,300	179,500	211,400
Inunduation Reduction Benefits	729,600	1,170,200	1,323,300

1/ All new and replacement units would be required to flood proof to the preproject 100-year level.

Using wind data from the "Cloverdale Peak" climatological station as discussed on pages C-14 and 15 of Appendix 1, wind wave and set computations were made. An average value of 1.5 feet was determined for these calculations. However, based on the relatively limited wind data and the distant location of the climatological station, it was determined that the reliability of the 1.5-foot computation was ±0.5 foot. Therefore, the average runup and set can be expected to be in the range of from 1 to 2 feet. To insure that the economic analysis was not overstated, a value of 1 foot was utilized, as stated above.

To verify the appropriateness of applying the 1 foot for every flood event around the entire rim of Clear Lake, the following rationale concerning the duration of lake flood events was utilized. For instance, in the 1958 flood, Clear Lake stood above flood stage for 82 consecutive days. During the 1970 flood, it stood above flood stage for 44 consecutive days. During these periods of high lake stages, winds occur from southerly, westerly, and northerly directions as a result of storm fronts moving inland from the Pacific Ocean. The direction and velocity of the winds will, of course, be dependent upon the pressure gradients of each storm system passing through the Clear Lake area. The important point is that for any particular flood, the lake stage remains high for a lengthy period of time, allowing sufficient time for the entire lake rim to feel the effects of the changing weather patterns and wind direction and velocity.

NATIONAL ECONOMIC DEVELOPMENT - EMPLOYMENT BENEFITS

38. The Area Redevelopment Act, Public Law 87-27, 87th Congress, 1st Session, and its successor, the Public Works and Economic Development Act of 1965, Public Law 89-136, 89th Congress, provide for the Federal Government to cooperate with the states to help areas of substantial and persistent unemployment and underemployment and to take effective steps

in planning and financing their economic development. Federal assistance should enable such areas to enhance the domestic prosperity by creation of new employment opportunities through development and expansion of new and existing facilities and resources. The role of the Corps of Engineers in the program is set forth in ER 1165-2-6, dated 1 February 1966, which also specifies the criteria to be used for project formulation and evaluation. It states that in addition to the criteria now in use, estimates of benefits may include an amount equivalent to that part of the construction costs which represents wages to workers who, in the absence of the project, would be unemployed. Lake County has been designated as eligible for assistance under the administration of the U.S. Department of Commerce.

39. The estimation of area redevelopment benefits for the selected plan is summarized in the following paragraphs. The NED employment benefits have been included in the benefit-cost ratio analysis presented in Section D.

40. NED employment benefits attributable to a project are equal to wages paid to local workers during construction who, during the absence of the project, would most likely be unemployed. Evaluation of construction costs of projects in California similar to the proposed plan indicates that about 32 percent of the Federal construction costs represent labor costs with about 45 percent of the labor provided by local workers, primarily from unskilled and semiskilled labor pools.

ANALYSIS

46. Benefits attributed to sediment control can be separated into two main categories. First, by controlled deposition of sediment in the Cache Creek Settling Basin, damages that may have occurred due to deposition in the Yolo Bypass and induced flooding elsewhere are prevented. Secondly, by control of sediment, reduced downstream dredging requirements are realized.

FLOOD DAMAGE PREVENTION

47. If sediment were allowed to continue to deposit in the Yolo Bypass, damage to development in the bypass would occur, and in addition, a backwater effect would be created which would cause infringement of the design flow on freeboard of the Yolo Bypass, Knights Landing Ridge Cut, and a portion of the Sacramento River. It would be necessary, in that case, to strengthen these levees and restore freeboard requirements. If sediment were controlled and caused to deposit upstream of the Yolo Bypass, there would be a benefit in so doing, as defined in the following analysis.

48. Sediment depositing in the Yolo Bypass in the vicinity of the Cobble Weir would inundate and render useless 435 acres of industrial waste oxidation ponds owned by the city of Woodland. The first cost to replace this facility is $840,000, the average annual cost of which is

$55,600. The 2,100 acres of agricultural land over which this sediment would deposit would not suffer significant losses in productivity. However, backwater effects caused by the sediment obstruction would be significant. The Yolo Bypass levees would need to be raised a maximum of 2.2 feet from 0.8 mile downstream of Interstate 5 upstream to the Fremont Weir, at a first cost of $2,894,000 and an average annual cost of $210,800. The Knights Landing Ridge Cut levees would need to be raised 1.8 feet at a first cost of $1,377,000 and an average annual cost of $101,900. Since backwater effects are still significant at the Fremont Weir, Sacramento River levees would need to be raised from that location downstream to the Sacramento Bypass at a first cost of $10,800,000 and an average annual cost of $746,000. The total first cost for such an activity, necessary to preserve the integrity of the Sacramento River Flood Control Project in the project area and prevent damages to development in the Yolo Bypass, would be $15,861,000, the average annual cost of which would be $1,114,300. This analysis is based on October 1977 price levels, a 6-5/8 percent discount rate, and a 50-year period of analysis. Plate F-4 shows the location of these levees; Plate F-5 shows flood profiles with and without sediment control.

49. To insure a conservative estimate of benefits, it is also necessary to examine flood damages that could occur should freeboard requirements not be reestablished on the levees previously described. If these average annual flood damages incurred were less than $1,114,300, this new figure should be used as a basis for benefits in keeping with the theory of "least costly alternative" analysis. Derivation of this

figure is described in the paragraphs below. Excavation of 100 acre-feet of sediment annually from the Yolo Bypass as a possible least-costly alternative was evaluated. The deposited sediment would be spread over thousands of acres of agricultural land over a period of years. In the Yolo Bypass, there would be no means of controlling the location of sediment deposition as is the case with the existing settling basin. Also, the excavated sediment would have to be placed somewhere. On pages D-26 and D-27 of Appendix 1, it was pointed out that disposal of 32 million cubic yards of sediment adjacent to and outside of the existing settling basin levees would cost about $44 million, excluding the value of land beneath the stockpiled sediment. However, the $44 million estimate was based on easily excavating the accumulated material and displacing it outside the settling basin. If the material were spread over thousands of acres in the Yolo Bypass, the cost of excavation and disposal would be significantly greater than if it were to be excavated and disposed of from the settling basin. Thus, this means of controlling sediment was not given extensive consideration.

50. Failure of the Sacramento River Flood Control Project could conceivably occur at any of an infinite number of locations in the project area. Six areas were selected as being representative. The tabulation on the following page identifies the location and land uses of each area. Plate F-4 shows the location of the flood plains.

LOCATION OF FAILURE	TOTAL ACRES INUNDATED	URBAN	AGRICULTURE						NATIVE
			ORCHARD	FIELD	TRUCK	GRAIN	RICE	PASTURE	
1. Yolo Bypass: Right Bank	12,340	540	-	3,540	670	2,390	3,470	120	1,610
2. Yolo-Bypass: Left Bank	12,300	310	3,400	3,270	1,340	2,570	530	600	280
3. Settling Basin: Right Bank	440	-	-	140	20	120	110	-	50
4. Knights Landing: Right Bank	7,780	30	30	1,050	2,170	3,030	220	1,150	100
5. Knights Landing: Left Bank	3,490	130	50	1,140	1,010	690	220	10	240
6. Sacramento River: Left Bank	53,330	2,640	-	16,620	1,030	13,200	19,070	550	220

51. Of these six areas, the first and last were evaluated in order to show the wide range of damages and benefits which could be experienced if the project failed. The right bank of the Yolo Bypass contains essentially 100 percent agriculture, while the left bank of the Sacramento River has an increasingly high level of residential, commercial, and industrial properties.

52. The Yolo Bypass, right bank, has 12,340 acres in its flood plain. The only major land use is agriculture, principally corn, grain, rice, and tomatoes. It was estimated that losses from a levee break would exceed $6 million, due to loss of production, loss of variable costs expended, and cleanup. Assuming a constant level of protection, average annual and average annual equivalent damages for the 50-year period are $31,000. A linear increase in water elevation in the Yolo Bypass results in an increase of damages over time. Average annual equivalent damages, at 6-5/8 percent, are $65,800. The difference, or benefit to the project, is $34,800 annually.

53. Potential damages from a levee break on the left bank of the Sacramento River are extremely high due to the high level of urban development in the area. Over 53,000 acres would be inundated from a break, with depths of flooding over 10 feet in much of the area.

54. A breakdown of land use and estimated losses, under existing conditions, is summarized below:

Land Use	Acres	Total Damages
Agriculture	50,685	$ 28,000,000
Residential	1,226	217,000,000
Commercial	29	7,000,000
Schools	58	5,000,000
Industrial	139	213,000,000
Airport	657	60,000,000
Vacant	536	-
Total	53,330	$530,000,000

63. As mentioned earlier, NED employment benefits attributable to a project are equal to wages, during construction, to local workers who, in the absence of the project, would most likely be unemployed. Of the total Federal construction costs, 32 percent represents labor costs, and 45 percent of the labor was assumed to be local labor, primarily at the unskilled and semiskilled levels.

64. Based on Federal construction costs of $8,220,000 for the Cache Creek Settling Basin project and the above assumptions, the total labor costs would be about $2,630,400 and local labor costs about $1,183,700.

65. Assuming an average salary of $26,000, the project would provide employment for about 45 local workers. Based on a 6-5/8 percent interest rate and a 50-year discounting period, the average annual equivalent value of the NED employment would be $81,700. The costs for operation, maintenance, and replacement were not included in the computation of employment benefits.

WILDLIFE ENHANCEMENT

66. Wildlife enhancement benefits associated with establishment of a wildlife refuge over the 3,600-acre Cache Creek Settling Basin have been provided by the U.S. Fish and Wildlife Service and coordinated with the California Department of Fish and Game. Monetary benefits attributed to hunter and visitor use were compiled in accordance with the Water

Resources Council's "Principles and Standards for Planning Water and Related Land Resources." Monetary benefits attributed to crop depredation benefits were provided to the U.S. Fish and Wildlife Service. Benefits were computed using standard methods, and verified against actual depredation losses suffered at similar type and size refuges, such as the Colusa National Wildlife Refuge, located in the northern Sacramento Valley.

67. The location of the proposed refuge would provide critically important wintering habitat for Pacific Flyway waterfowl. In terms of migratory bird use, 4.6 million waterfowl use days and 108,000 shore and marsh bird use days can annually be attributed to the refuge. In addition, the increased wetland habitat development would allow for improved distribution of wintering waterfowl in the Central Valley, reducing crop depredation losses and bird losses due to disease.

68. The proposed refuge would complement the Fish and Wildlife Service's operations at Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges and the California Department of Fish and Game's refuge at Gray Lodge, and Grizzly and Joice Islands. The refuge would, as a result, contribute significantly to the further implementation of the National Migratory Bird Management Program as identified in the Fish and Wildlife Service's "Concept Plan for Waterfowl Wintering Habitat Preservation - Central Valley California."

In terms of monetary benefits, the U.S. Fish and Wildlife Service has determined that all costs associated with establishing the refuge may be properly considered as a direct positive benefit to waterfowl and are fully offset by increased bird use days and the refuge's contribution to the U.S. Fish and Wildlife National Migratory Bird Management Program. These annual benefits total $282,000 and represent the least costly alternative means of establishing a similar refuge supporting equivalent bird use in Yolo County.

69. Additional benefits to be gained as a result of development of the refuge include reduction in crop depredation losses and increased hunting and general recreation opportunities. Crop depredation benefits total $75,000. Hunting would provide for a net increase of 7,450 recreation days at $9 per day, totaling $67,000. Additionally, approximately 39,000 recreation days (at $2/day) would create $78,000 in annual benefits. Visitation and hunting benefits were developed in conjunction with the U.S. Fish and Wildlife Service and were based upon actual use of refuges of similar size and type located in California's Central Valley.

70. Total annual wildlife enhancement benefits are summarized below:

	Benefits
Reduced disease losses and contribution to the National Waterfowl Management Program (Discounted 6-5/8%)	$282,000
Reduced Crop Depredation	75,000
Hunting	67,000
Visitation	78,000
	$502,000

Table F-2 indicates that average annual costs attributed to the wildlife refuge total $222,400. As tabulated above, average annual wildlife enhancement benefits total $502,000. Thus, the incremental benefit-cost ratio of the wildlife refuge is 2.3 to 1.

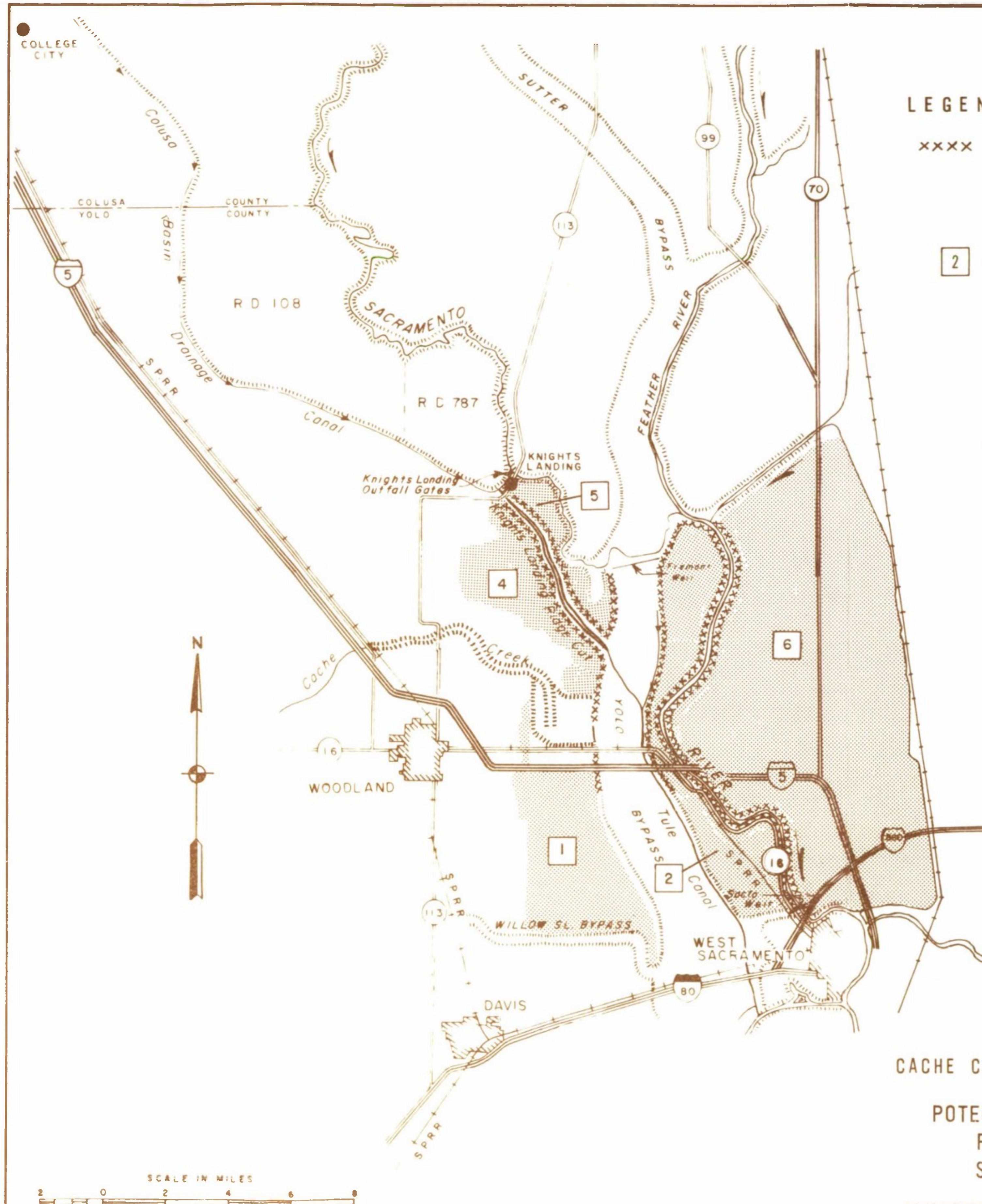
Summary of Benefits

71. Shown in table F-18 below is a summary of average annual benefits associated with water resource related improvements in the upper and lower Cache Creek Basin. It should be noted that a potential project benefit exists for revenue that could be obtained by the sale of 50,000 cubic yards of sediment annually to topsoil distributors. However, such a benefit has not been claimed since it is assumed that any benefit would be offset by costs of removal.

Table F-18

SUMMARY OF BENEFITS

Upper Basin	
Flood Control	$1,170,200
NED Employment	35,700
Total	1,205,900
Lower Basin	
Flood Control	1,114,300
Sediment Control	268,000
NED Employment	81,700
Wildlife Enhancement	502,000
Total	1,966,000
Project Total	3,171,900



LEGEND:

×××× Levees which would have to be raised without sediment control. Water surface profiles shown on Plate F-5.

2 Denotes flood plain areas for various potential levee failures without sediment control. Numbers correspond to locations described on page F-39.

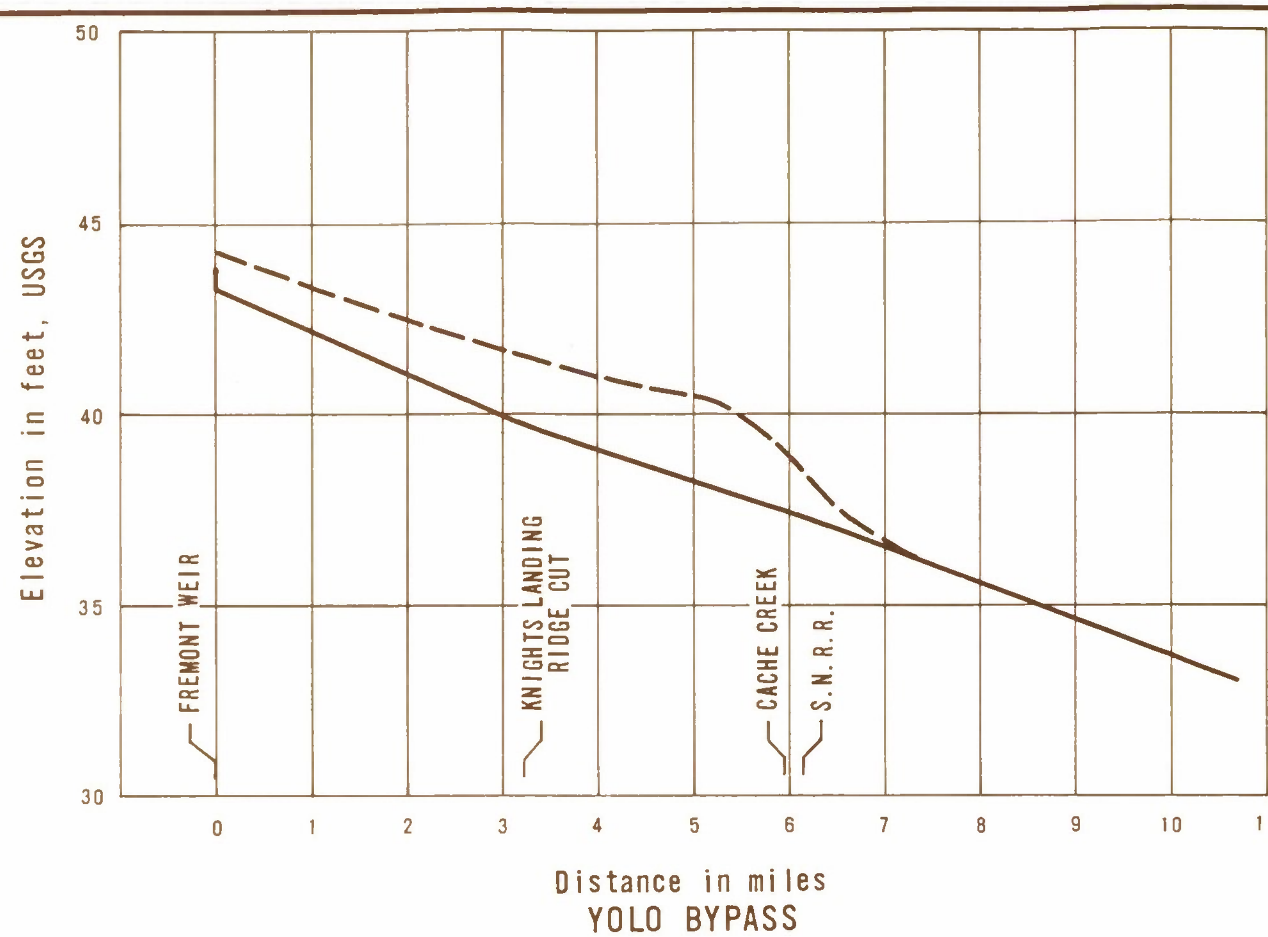
NOTE:

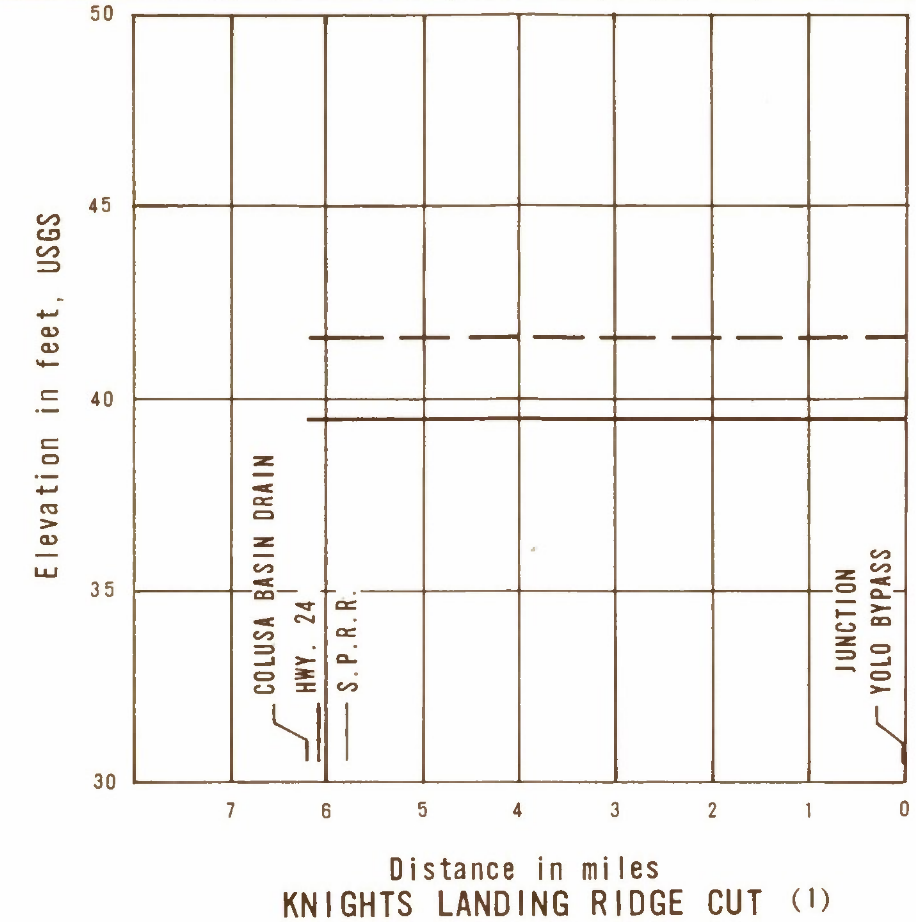
Flood plain 3 (see page F-39) is not shown due to insignificant size (400 acres) when compared to other areas (53,000 acres).

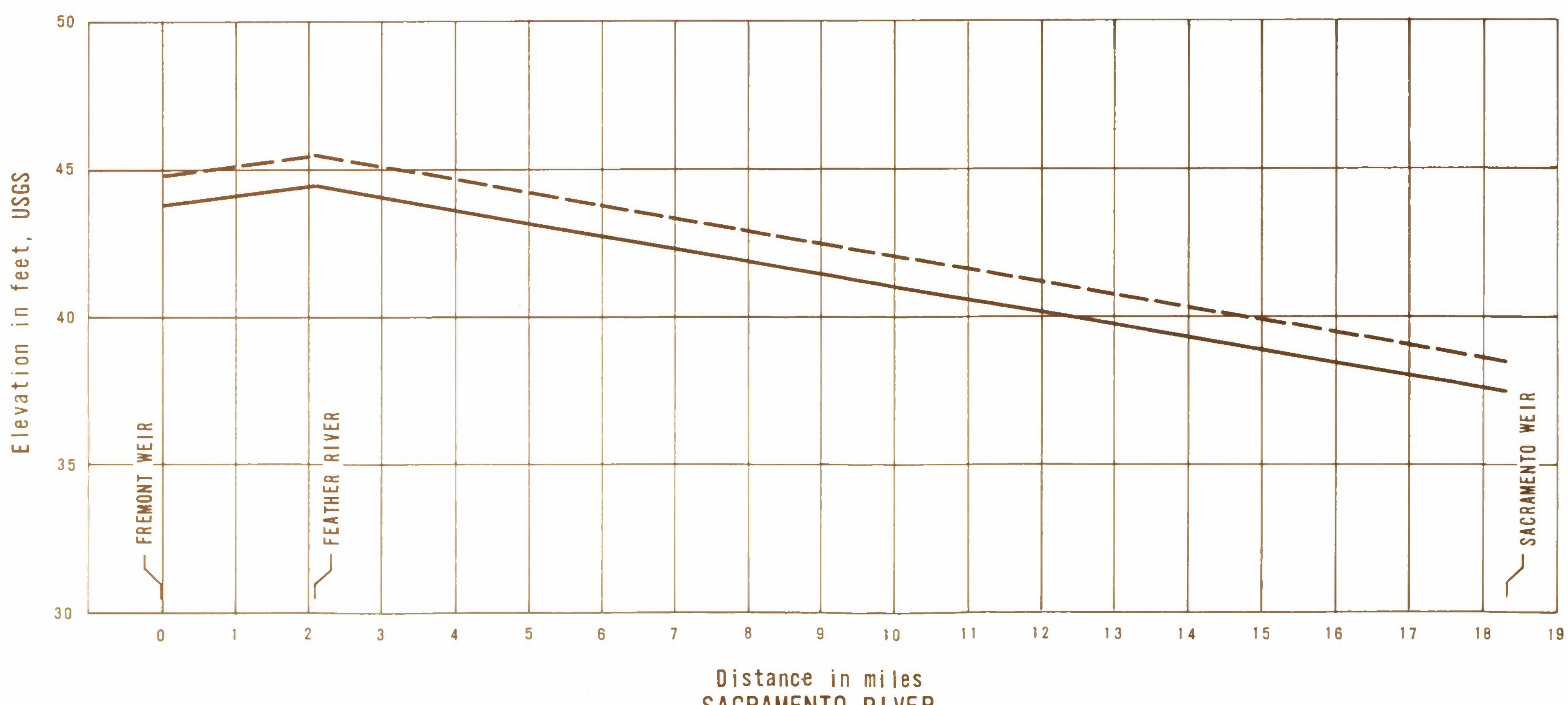
CACHE CREEK BASIN, CALIFORNIA

POTENTIAL FLOOD CONTROL PROBLEMS WITHOUT SEDIMENT CONTROL

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
MARCH 1980







LEGEND

— — — Design Water Surface Profile without Sediment Control.

——— Design Water Surface Profile, Existing Conditions.

(1) Design flow in Yolo Bypass, zero flow in Knights Landing Ridge Cut.

CACHE CREEK BASIN, CALIFORNIA

DESIGN FLOOD PROFILES WITH AND WITHOUT SEDIMENT CONTROL

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
MARCH 1980

NOTES:

Preproject Standard Project Flood plain elevation is 13.01 feet on the Rumsey Gage at Lakeport (1,331.66 feet Mean Sea Level Datum).

Preproject 100-Year flood plain elevation is 11.85 feet on the Rumsey Gage at Lakeport (1,330.50 feet Mean Sea Level Datum).

Clear Lake stage in photo was 5.44 feet on the Rumsey Gage at Lakeport (1,324.09 feet Mean Sea Level Datum).

LEGEND:

— – — 100-Year flood plain.

– – – – – Standard Project Flood plain.

SCALE IN FEET

500 0 500 1000 1500

N

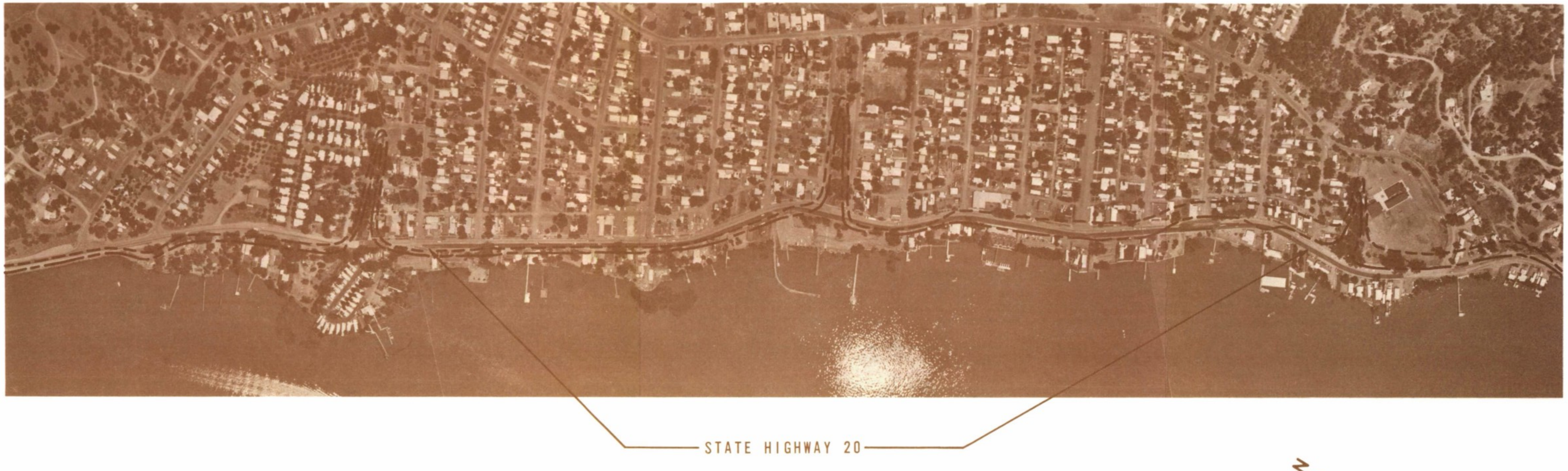
CACHE CREEK BASIN, CALIFORNIA

PREPROJECT 100-YEAR AND STANDARD PROJECT FLOOD PLAINS

LAKEPORT AREA

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

MARCH 1980



NOTES:

Preproject Standard Project Flood plain elevation is 13.01 feet on the Rumsey Gage at Lakeport (1,331.66 feet Mean Sea Level Datum).

Preproject 100-Year flood plain elevation is 11.85 feet on the Rumsey Gage at Lakeport (1,330.50 feet Mean Sea Level Datum).

Clear Lake stage in photo was 5.44 feet on the Rumsey Gage at Lakeport (1,324.09 feet Mean Sea Level Datum).

LEGEND:

— – — 100-Year flood plain.

– – – – – Standard Project Flood plain.

SCALE IN FEET

500 0 500 1000 1500

CACHE CREEK BASIN, CALIFORNIA

PREPROJECT 100-YEAR AND STANDARD PROJECT FLOOD PLAINS

LUCERNE AREA

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
MARCH 1980

NOTES:

Preproject Standard Project Flood plain elevation is 13.01 feet on the Rumsey Gage at Lakeport (1,331.66 feet Mean Sea Level Datum).

Preproject 100-Year flood plain elevation is 11.85 feet on the Rumsey Gage at Lakeport (1,330.50 feet Mean Sea Level Datum).

Clear Lake stage in photo was 5.44 feet on the Rumsey Gage at Lakeport (1,324.09 feet Mean Sea Level Datum).

LEGEND:

— – — 100-Year flood plain.

– – – – Standard Project Flood plain.

CACHE CREEK BASIN, CALIFORNIA

PREPROJECT 100-YEAR AND STANDARD PROJECT FLOOD PLAINS

CLEAR LAKE HIGHLANDS AND CLEAR LAKE PARK AREA

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
MARCH 1980

Comment	Location of Modification	Agency/ Organization
Discuss seismic aspects of Cache Creek Basin	Appendix 1, page B-5 and EIS page 13	State of California
Discuss mineral deposits of Cache Creek Basin	Appendix 1, page B-5 and EIS pages 4 and 13	Bureau of Mines, State of California
Clarify habitat of bald eagle	Appendix 1, page B-12	Audubon Society
Discuss archeological resources of settling basin area	Appendix 1, page B-18	National Park Service
Ground water overdraft	Appendix 1, page C-54	Yolo County Flood Control and Water Conservation District
Discuss need to relocate sewers and storm drains	Appendix 1, page E-21, EIS page 2	City of Woodland
Discuss impact on Seigler Creek	Appendix 1, page E-11, EIS page 13	James Berwick
Discuss how increased flow will affect gravel operations	EIS page 13	State of California
Discuss maintenance aspects of reestablishing vegetation along channels	EIS page 14	State of California
Discuss stabilization of borrow material	EIS page 14	State of California
Discuss impact on aquatic productivity	EIS page 15	Fish and Wildlife Service
Solicit input from Native American community	EIS page 16	National Park Service
Include discussion of items eligible for the National Register of Historic Places	EIS page 16	National Park Service

Comment	Location of Modification	Agency/ Organization
Discuss saleability of topsoil	EIS page 18	City of Woodland
Discuss effect of reducing flood frequency on wildlife habitat	EIS page 29	Fish and Wildlife Service
Discuss long-term impact of fish and wildlife resources	EIS page 29	Fish and Wildlife Service
Discuss sediment studies under Section 208 of Public Law 92-500	Appendix 1, Page D-14	State of California and Yolo County Resource Conservation District
Discuss how sediment will be disposed of and availability of a local market	Appendix 1, Page E-18	City of Woodland
Discuss increased annual operating costs for City of Woodland storm drains	Appendix 1, Page E-23	City of Woodland
Show compliance with Section 106 of National Historic Preservation Act	EIS, page 16	Advisory Council on Historic Preservation

This final environmental statement is an accompanying document to the feasibility report and, to avoid duplication, many items already discussed in detail in the feasibility report (particularly descriptions of the present environment) are not repeated in this final statement. Letters and numbers appearing in parenthesis refer to sections and pages in Appendix 1 where more detailed information appears. Letters of comment received on the draft environmental statement, as well as responses to those comments, are included in Appendix 2. Many revisions and clarifications suggested in the letters of comment have been incorporated into this final environmental statement and the feasibility report.

SUMMARY

Cache Creek Basin, California, Investigation
Final Environmental Statement

Responsible Office: U.S. Army Engineer District, Sacramento, California

1. Name of Action: ( ) Administrative (X) Legislative

2. Description of Action: The proposed plan includes construction of flood control facilities at the outlet of Clear Lake in Lake County, California, to provide flood protection to existing and future urban and agricultural development on the Clear Lake rim. The plan calls for widening and deepening the existing Clear Lake Outlet Channel, constructing a bypass channel, and requiring future development to flood proof to the elevation of the preproject flood plain. The plan also includes sediment control on Cache Creek in Yolo County, California, to preserve the integrity of the Sacramento River Flood Control Project. The plan for the settling basin calls for enlarging existing perimeter levees, reconstructing and enlarging the existing Cobble Weir, rebuilding existing training levees, establishing a wildlife refuge, and annually excavating sediment.

3. a. Environmental Impacts: Property damage and other adverse environmental impacts associated with severe flooding would be alleviated. Wildlife and public recreation benefits would accrue at the settling

basin. The integrity of existing flood control facilities would be maintained.

b. Adverse Environmental Impacts: About 71 acres of grassland and 3 acres of riparian forest would be converted to a flood control channel. Approximately 250 acres of agricultural land would also be occupied by project features, and agricultural production on an additional 3,350 acres would be reduced because of wildlife area operation. Temporary impacts would accrue to resident fish and wildlife, water quality, air quality, and esthetics but would be mitigated. Thirteen residences require relocation.

4. Alternatives: No action, flood forecasting, evacuation of the flood plain, flood proofing, construction of reservoirs, modification of Clear Lake operation, and several combinations of these were considered for the upper basin. No action, nonstructural, basin excavation, new basin construction, Kellner jetty system, a sediment reservoir, and several combinations of these were considered for the lower basin.

5. Comments Received:

a. Federal agencies

(1) Department of the Interior

Bureau of Indian Affairs

Bureau of Land Management

Bureau of Mines

Bureau of Reclamation

Fish and Wildlife Service

Geological Survey

Heritage Conservation and Recreation Service

National Park Service

(2) Department of Agriculture

Soil Conservation Service

(3) Environmental Protection Agency

(4) Federal Highway Administration

(5) Department of Commerce

(6) Advisory Council on Historic Preservation

b. State agencies

(1) Resources Agency

(2) Department of Transportation

c. Local agencies and citizens groups

(1) Lake County

(2) Yolo County

(3) Clear Lake Water District

(4) Lake County Flood Control and Water Conservation District

(5) Yolo County Flood Control and Water Conservation District

(6) Audubon Society

(7) Sierra Club

(8) Clear Lake Water Quality Council

(9) Yolo County Resource Conservation District

(10) City of Woodland

6. Draft to EPA 21 February 1978

Final to EPA ____________

CACHE CREEK BASIN
FINAL ENVIRONMENTAL STATEMENT

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

420,000 at 7.56 feet on the Rumsey gage. Average annual runoff of Cache Creek near Lower Lake is calculated to be 254,000 acre-feet. Approximately 96,000 acre-feet annually is being diverted from Cache Creek and used for irrigation mainly in the Lower Cache Creek area. The amount of water which can be depended upon (safe yield) is estimated to be only 46,000 acre-feet. Ground water is also extensively used for irrigation in the Lower Cache Creek area. Safe yields of ground water are estimated to be 200,000 acre-feet per year; however, present use is estimated to be 222,000 acre-feet per year (B-5, B-6, C-54).

2.05 Vegetation. - The plant communities identified in the project area are foothill-woodland, chaparral, valley grassland, riparian, and marsh. Along the Clear Lake Outlet Channel, residential development is scattered through riparian plant communities. Away from the riparian zone, stands of valley and live oak and open grasslands occur. Approximately 90 percent of the Cache Creek Settling Basin is under cultivation with the remaining 10 percent in sandbar willow (B-7 through B-9 and B-12, B-14).

2.06 Fish and wildlife. - The Clear Lake and Cache Creek areas support a diverse wildlife population. The State of California has rated Clear Lake as Class I - premium waterway and Cache Creek above the diversion dam as Class II - very good waterway for warmwater fisheries. Cache Creek below Capay is intermittent and supports minimal aquatic life. The State of California has indicated that Anderson Marsh, adjacent to the Clear Lake Outlet Channel, is important in maintaining the biological productivity of Clear Lake. Wildlife inhabiting the

proposed settling basin is similar to that on adjacent agricultural land. The settling basin is within the Pacific Flyway, and the Yolo-Bypass area is utilized by approximately 300,000 wintering waterfowl. The southern bald eagle (Haliaeetus leucocephalus), American peregine falcon (Falco peregrinus anatum), and California yellow-billed cuckoo (Coccyzus americanus occidentalis), whose ranges include the Clear Lake and Cache Creek areas, are found on the Federal and State rare and endangered species lists. However, inclusion of these species on these lists does not indicate their presence within the project area but acknowledges their possible presence based upon distributional characteristics of each species (B-9 through B-13).

2.07 Archeology and history. - The Clear Lake area has been the site of human habitation for the past 10,000 years. The pleasant climate and abundant resources made it one of the most densely populated areas in the State. Trapping originally brought the Anglo-American into the Cache Creek Basin, but agriculture has been dominant in its more recent history (B-17 through B-20).

2.08 Population. - The project area encompasses two counties, Lake and Yolo. Lake County had a 1976 population of 27,600. Development in the county has occurred mainly around the Clear Lake rim where two-thirds of the county's permanent population resides. Yolo County had an estimated 1976 population of 104,700 persons. Woodland (population 25,150), located partially within the Cache Creek Basin, is the major population center (B-20 through B-30).

of this cropland would be permanently taken out of production for levee rights-of-way, and 260 acres would be temporarily disrupted for borrow material. In the areas where sediment is being periodically excavated, all vegetation would be removed. Refuge operations by the U.S. Fish and Wildlife Service will call for some or all of the land to be farmed on a crop-sharing basis, with the farmers growing only certain crops and leaving a portion of their harvest for wildlife. Mitigation measures for the habitat destroyed in the Clear Lake area include appropriately shaping lands and replanting vegetation on disturbed areas after construction. In addition, new riparian vegetation will be established along the 1.1-mile-long bypass channel.

4.04 Fish and wildlife. - Wildlife populations around the channel enlargement and bypass channel area would be temporarily displaced during construction. Wildlife populations would also be temporarily displaced from the dredged material disposal site. Aquatic productivity in the existing outlet channel would suffer a short-term loss due to blasting and dredging. The additional habitat being developed by construction of the bypass channel, including provision of fish habitat structures, would fully compensate for aquatic habitat losses. The channels would also be restocked with aquatic species following construction. The settling basin would be changed from a solely agricultural to an agricultural and wildlife habitat suited particularly to migratory waterfowl. Nonmonetary benefits attributed to the refuge would include 4.6 million waterfowl use-days and 108,000 shorebird and marshbird use-days annually. The settling basin will be

managed as a wildlife refuge with some continuing agricultural productivity, and the habitat within the basin would be manipulated for the mutual benefit of wildlife and sediment removal. Proper operation of the refuge would reduce waterfowl and crop depredation losses on lands surrounding the basin. The U.S. Fish and Wildlife Service, by letter dated 26 July 1977, indicated that it foresaw no need to recommend any land acquisition for mitigative purposes for proposed plans in upper or lower Cache Creek Basin. The project will have no discernable effect on any identified rare or endangered fish, wildlife, or plant species.

4.05 Archeology and history. - An intensive cultural resources survey of the proposed bypass channel and a reconnaissance level survey of the levee construction project were completed for the Corps in April 1977 by Sonoma State University in accordance with Section 106 of the National Historic Preservation Act and current regulations. No historic sites were discovered within the project area; however, 10 archeological sites were found which could be affected by the project within the Clear Lake to Clear Lake Dam area. Seven of these sites are in the Anderson Marsh Archeological District as listed in the National Register of Historic Places (44 FR 7430-6 Feb 1979). The specific limits of the sites are unknown at this time. If the project is authorized, a comprehensive cultural resources survey will be conducted and mitigative/protective measures recommended. At that time, the significance of any additional sites located within the project boundary will be considered under the National Register of Historic Places criteria. The California State Historic Preservation Officer (SHPO) concurred

with the recommendations of Sonoma State University to alleviate adverse impacts to cultural resources.

In accordance with 36 CFR 800 and 33 CFR 305 regulations, protective/ mitigative measures for any affected archeological sites would be closely coordinated with the SHPO and the Advisory Council on Historic Preservation. Such measures could be one or a combination of the following:

- Avoid any damage through redesign of the project features, if feasible.

- Scientifically excavate and analyze all or part of the sites prior to construction.

- Arrange for a professional archeologist to be available during construction activities in the event that any presently unidentified sites are discovered.

Appropriate Native American organizations also would be advised of the project and its anticipated impact on cultural resources.

4.06 Land use. - Land use around the Clear Lake rim is not expected to change because of the project. Even though the 100-year flood level will be dropped 2 feet, the project will provide a high degree of flood protection because of continuation of existing zoning regulations. With this regulation, future development will be required to flood proof to at least the level of the preproject 100-year flood level. An analysis of the projects impact on the base flood plain was made in accordance with Corps of Engineers regulation, "Implementation of Executive Order 11988 of Flood Plain Management," (33 CFR 239). The

selected plan requires that future development meet existing requirements to flood proof or otherwise construct above the elevation of the preproject 100-year flood plain. As a result, the project would not cause any change or provide direct or indirect support of development in the base flood plain and therefore no further analysis under Executive Order 11988 is required. Similarly, developments within the Cache Creek Settling Basin are consistent with flood control and sediment control purposes of the basin and will have no impact on the base flood plain.

Construction of the bypass and channel enlargement would change the land use on 71 acres from grassland to a flood control channel. Another 80 acres will be utilized for spoil disposal. Present land uses will be eliminated in this area for approximately 5 years to allow for revegetation and settling of the soil.

Construction of the settling basin would reduce agricultural production on 3,600 acres of agricultural land. The land use would change to one of sediment removal and wildlife refuge with some continuing agricultural production, as described in paragraphs 4.03 and 4.04. Approximately 250 acres would be converted from cropland to levee. Private hunting clubs in the settling basin would be abolished. Since the need for annual excavation of sediment from the ship channels would be reduced by approximately 240 acre-feet, the need for land disposal areas for this material would be reduced. An opportunity exists to improve the quality of nearby farmland by application of sediment deposited in the settling basin.

4.07. Socioeconomic conditions. - Socioeconomic conditions would remain essentially unchanged from the existing conditions. The State of California has indicated that 3 residences in the settling basin would require relocation and 10 residences along Cache Creek and the new channel would require relocation. These relocations will affect about 33 people. These families would qualify for assistance under the Uniform Relocations Act. Numerous boat docks and piers would need to be temporarily removed or relocated during construction, causing an inconvenience. Residents near the construction areas may be disturbed

Syllabus

The purpose of this study was to investigate flood, sediment deposition, and related water resource problems in Cache Creek Basin to determine the need for and feasibility of improvements to solve these problems.

The principal areas of concern included a flood problem on the rim of Clear Lake in Upper Cache Creek Basin and a sediment control problem in Lower Cache Creek Basin. The Clear Lake flood problem is caused by the inability of the 5-mile-long Clear Lake Outlet Channel to discharge sufficient floodflows to keep pace with inflow to the lake. The sediment control problem is caused by the fact that the existing sediment control facility, the Cache Creek Settling Basin, has nearly lived its useful life. Consequently, it is no longer trapping sufficient quantities of sediment necessary to prevent deposition in the Yolo Bypass (a unit of the Sacramento River Flood Control Project), downstream navigation channels, and San Francisco Bay.

The plans selected as a result of this investigation include enlargement of 3.3 miles of the Clear Lake Outlet Channel and construction of a 1.1-mile-long bypass channel around the highly developed portion of the existing channel. This portion of the project would have an estimated first cost of $6,050,000 and an average annual cost of $413,000. With average annual benefits of $1,205,900, this portion of the project has a benefit-cost ratio of 2.9 to 1. To control sediment in the Lower Basin, the perimeter levees of the existing Cache Creek Settling Basin would be enlarged to provide sediment storage capacity. To provide critically important wintering habitat for Pacific Flyway waterfowl and contribute to the National Migratory Bird Management Program, the entire 3,600-acre settling basin would be purchased in fee and a National Wildlife Refuge would be established. This portion of the project would have an estimated first cost of $11,910,000 and an average annual cost of $966,000. With average annual benefits of $1,966,000, this portion of the project has a benefit-cost ratio of 2.0 to 1.

It is recommended that, subject to certain conditions of non-Federal cooperation as outlined in this report, the proposed plans be authorized for construction. Estimated first and annual costs to the United States are $13,753,000 and $1,062,600, respectively. Estimated non-Federal first and annual costs are $4,207,000 and $316,900, respectively. These costs are based upon the President's recently proposed cost-sharing methods. Cost sharing based upon traditional cost-sharing policy is also included in this report for comparative purposes.

CACHE CREEK BASIN, CALIFORNIA

FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT FOR WATER RESOURCES DEVELOPMENT LAKE AND YOLO COUNTIES, CALIFORNIA

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

LIST OF PHOTOGRAPHS

LIST OF PHOTOGRAPHS (Cont'd)

LIST OF TABLES

LIST OF PLATES

LIST OF APPENDIXES

FEBRUARY 1979

CACHE CREEK BASIN, CALIFORNIA

FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT
FOR WATER RESOURCES DEVELOPMENT
LAKE AND YOLO COUNTIES, CALIFORNIA

The Study and Report

Purpose and Authority

The purpose of this study was to investigate flood, sediment, and related water resource problems and needs of the Cache Creek Basin and describe the various alternatives considered to help solve the problems.

This report has been prepared in response to a resolution by the Committee on Flood Control of the House of Representatives dated 29 May 1946 concerning protection against floods in the Clear Lake area and a resolution by the Committee on Public Works, House of Representatives, dated 19 June 1963, regarding the Cache Creek Settling Basin.

Scope of the Study

Cache Creek Basin, the study area, lies on the eastern slope of the Coast Range adjacent to the Eel River, Stony Creek, and Putah Creek Basins. The basin drains 1,150 square miles, including portions of Colusa, Lake, and Yolo Counties, and is naturally divided into two areas: the Clear Lake area, including tributaries to the lake, and the Cache Creek area, comprised of Cache Creek and its tributaries.

Several alternatives to help solve flood, sediment, and related water resource problems of the Cache Creek Basin were investigated on a preliminary basis. From these alternatives, the most desirable plans were selected based upon wishes of local interests; environmental, social, and economic acceptability; and cost feasibility. Detailed studies of these plans were then made.

Study Participants and Coordination

Study participants included concerned Federal, State, and local agencies. Coordination was conducted with the Reclamation Board of the State of California, California Department of Fish and Game, Lake County and Yolo County Flood Control and Water Conservation Districts, the U.S. Fish and Wildlife Service, Environmental Protection Agency, and many local agencies, citizen groups, and individuals.

An initial public meeting was held in Woodland on 2 July 1969 to give Federal, State, and local interests an opportunity to express their ideas regarding problems and possible solutions in the study area. During the plan formulation stage of the investigation, an Information Brochure, "Investigation for Flood Control and Related Purposes, Cache Creek Basin, California," dated November 1975, was published and two public meetings were held to present to the public alternative solutions studied for flood control, sediment control, and associated needs in the Cache Creek Basin. These meetings were held on 2 and 4 December 1975 and were sponsored by the Lake County and Yolo County Flood Control and Water Conservation Districts, respectively. Final public meetings were held on 20 and 21 March 1978 to present the selected plans to the public.

The Report

This report is arranged into a main report and six appendixes, one of which is a Technical Report. The main report essentially summarizes the technical report but also contains material on plan implementation, coordination, and recommendations. The Technical Report, Appendix 1, presents more detailed aspects of the study for the technical reviewer. Appendix 2 contains correspondence received as a result of coordination of the draft feasibility report and environmental statement (EIS) and also contains responses to comments received on the draft EIS. Appendix 3 contains a copy of the Gopcevic Decree of 1920 and a copy of the Bemmerly Decree of 1940. Appendix 4 is the EIS. In accordance with guidance from the Council on Environmental Quality (CEQ), the EIS has been limited to a concise analysis and evaluation of the significant impacts of the proposed plan and alternatives to the proposed plan so that the document will be more readable and more useful to the public and decision makers. Detailed information is contained in Appendix 1 and is referenced where appropriate in the EIS. A

Section 404 Evaluation Report is included in this report as Appendix 5, and a summary of this evaluation is contained in the environmental statement (Appendix 4). Appendix 6 contains reports of others and pertinent correspondence other than that obtained as a direct result of coordination of the draft feasibility report and EIS.

Prior Studies and Reports

The Corps of Engineers investigated the Clear Lake-Cache Creek Basin in the late 1940's to determine methods to solve flood and water resource problems in the basin, and in a "Review Report on Cache Creek Basin, California," dated July 1950, proposed reservoirs on North Fork Cache Creek and Kelsey Creek.

The Bureau of Reclamation studied development of the water resources of the Clear Lake-Cache Creek Basin as a part of "The Comprehensive Plan for Central Valley Basin, California," dated May 1974.

The U.S. Soil Conservation Service is currently in the final feasibility stage of planning two watershed projects that are in the vicinity of Cache Creek. These projects are:

a. The Cottonwood-Willow Slough Watershed Project, adjacent to the Cache Creek Basin, south of Capay, and the Lamb Valley Diversion, a feature of this project, would divert floodflows into Cache Creek near Capay.

b. The Dry Slough - Davis Area Watershed Project is adjacent to the south boundary of the Cottonwood - Willow Slough watershed. Project features, including a diversion of Chicahominy Slough floodflows into Putah Creek, would reduce floodflows into Willow Slough.

The State of California, Department of Water Resources (DWR), studied possible diversion schemes for transporting and integrating Eel River water into the State Water Project. In some of the schemes, diverted water would be transported through the Cache Creek Basin. However, in December 1972 the State established the California Wild and Scenic Rivers System, and portions of the Eel River are part of this system. Consequently, DWR terminated studies and in December 1972 published a report presenting the alternative plans involving the Eel River.

DWR in 1968 and 1972 prepared reports indicating that the Cache Creek Settling Basin storage capacity was nearly depleted; the reports discussed solutions to the sediment deposition problem.

Lake County Flood Control and Water Conservation District had two reports prepared in January and November 1973 concerning the Kelsey Creek Water Supply Project, which would consist of constructing Pomo Reservoir (Kelseyville Reservoir) on Kelsey Creek for irrigation, domestic water supply, and recreation. These reports were prepared to comply with the requirements for a Small Reclamation Project (Public Law 984) Federal Loan. One of the preferred alternatives indicated in the reports was diversion of flows through Clear Lake for use in the State Water Project.

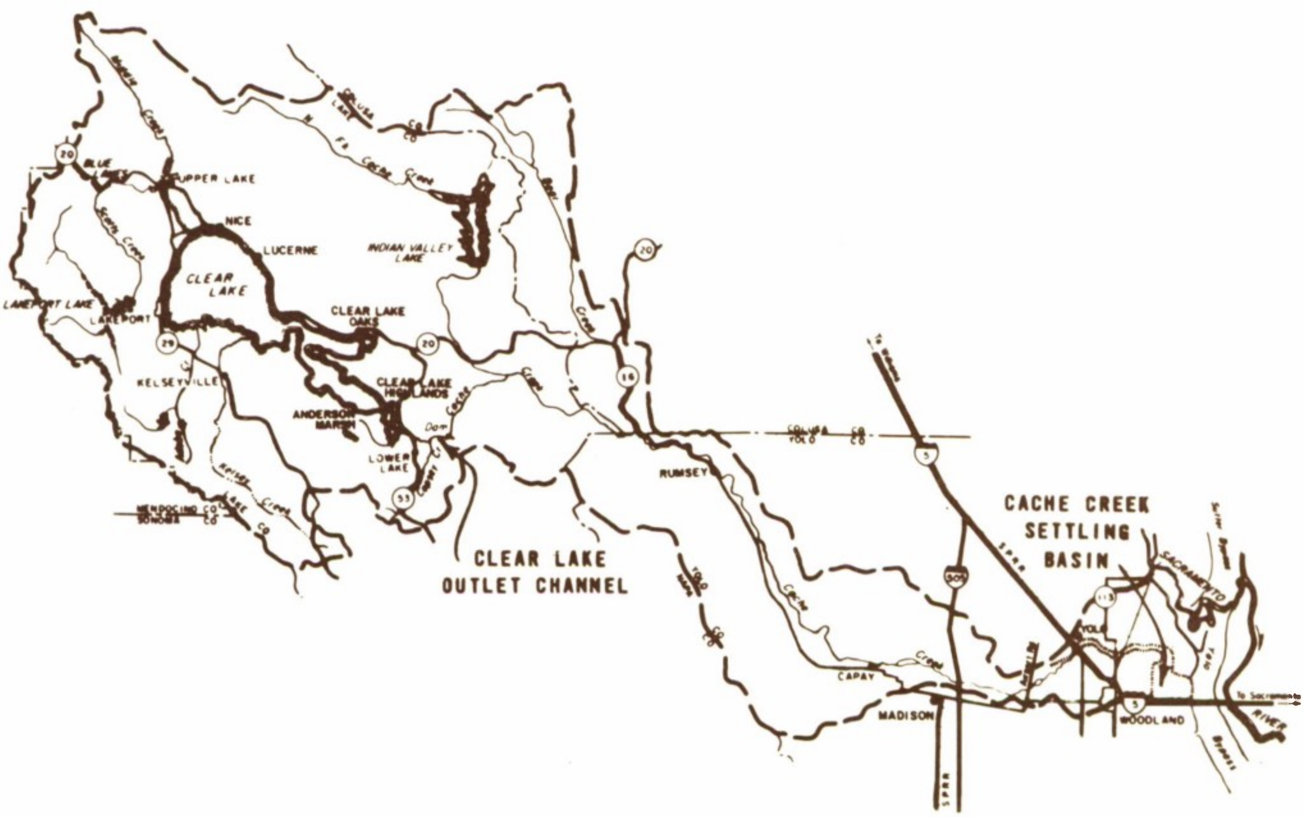
The Development and Resources Corporation prepared a report entitled, "Lake County Resource Management Plan" for the Lake County Flood Control and Water Conservation District. This report addressed the water supply needs of Lake County.

The Yolo County Flood Control and Water Conservation District has had reports prepared to meet requirements for a Small Reclamation Project (Public Law 984) Federal loan for construction of Indian Valley Reservoir. The reservoir was subsequently completed in 1975 and is operated for flood control in accordance with the October 1977 Report on Reservoir Regulation for Flood Control by the Sacramento District, Corps of Engineers.

Resources and Economy of the Study Area

Environmental Setting and Natural Resources

The study area is the Cache Creek Basin shown below and on the General Map, plate 1. The basin naturally divides into two areas, Clear Lake and tributaries in Lake County and Cache Creek and tributaries in Yolo County.



Clear Lake, located about 110 miles north of San Francisco and 110 miles northwest of Sacramento, is a 63-square-mile natural lake with a 100-mile-long shoreline, a maximum depth of 60 feet, and average winter and summer temperatures of 40 and 76 degrees Fahrenheit, respectively. Its principal tributaries are Scotts, Middle, and Clover Creeks entering from the north and Kelsey and Adobe Creeks entering from the south. Clear Lake discharges by way of the 5-mile-long Clear Lake Outlet Channel, including the Grigsby Riffle, a natural geologic obstruction, and through the Clear Lake Dam into Cache Creek.

North Fork Cache Creek and Bear Creek, the two main tributaries of Cache Creek, enter the main stream 9 and 24 miles, respectively, downstream of the Clear Lake Dam. Below the Clear Lake Dam, Cache Creek descends through the rugged, 30-mile-long Cache Creek Canyon, emerges into the scenic Capay Valley, and meanders through the productive agricultural lands of Yolo County into the Yolo Bypass. Before discharging into the Yolo Bypass, a portion of Cache Creek's heavy sediment load deposits in the Cache Creek Settling Basin at the mouth of the creek.

The climate of the area is characterized by warm, dry summers with temperatures frequently exceeding 100 degrees and mild winters with temperatures seldom falling below freezing. Frost-free periods in agricultural areas average about 250 days along Cache Creek and 220 days around Clear Lake. About 95 percent of the annual precipitation occurs from October to April, varying from 17 to above 60 inches from the lower to the upper reaches of the basin and averaging about 32 inches.

Clear Lake itself is far from "clear" because of algal growth. Although the natural ecosystem of the lake causes the algal blooms, the proportion of pollutants in the lake has been aggravated by increased population and agricultural development. Despite the algal condition of the lake, it is one of the best warmwater fisheries in California and is extensively used for recreation.

Much of the land adjacent to Clear Lake is agricultural. Most of the irrigable land is intensively cultivated in orchards and row and field crops, and nonirrigable land produces barley and range grasses. Although the upland portions of the upper basin are steep and generally unsuitable for agriculture because of poor soils and lack of water, there is sufficient natural growth to support many species of game and nongame animals. Rare and endangered species such as the bald eagle, peregrine falcon, and yellow-billed cuckoo have been observed in the upper basin.

Vegetation in Cache Creek Canyon and higher elevations varies with slope exposure and elevation. Dense chaparral covers much of the drainage area, and blue oak and Digger pine grow on many of the lower slopes. Sheltered north and east slopes at the higher elevations often have stands of Douglas-fir or yellow pine. Canyons and river bottoms have a large variety of tree and shrub species. The "flats" along Cache Creek in the canyon are productive deer habitat areas.

The same species of wildlife found near Clear Lake are also present in the canyon area, but in addition, a herd of about 170 Tule elk ranges throughout Cache Creek Canyon. The marshy areas along Bear Creek, and to a lesser extent along Cache Creek, provide the main source of summer forage for the elk.

Lower End of Clear Lake
with Anderson Marsh in Foreground
May 1975

Rugged Mountainous Area
Between Clear Lake and Capay Valley
May 1975

Rich Agricultural Lands of Capay Valley,
with State Highway 16 in Foreground, Cache Creek on Right
May 1975

Corps of Engineers Project Levees
Immediately Upstream of Cache Creek Settling Basin
May 1975

Some small game and fur bearing animals inhabit the lower part of the basin below Rumsey, but their natural habitat is limited. Since the channel is dry most of the year, the fishery is insignificant.

Archeological investigations have established Clear Lake as the site of human life for at least the past 8,000 years. Before the coming of the white man, Lake County was inhabited by about 5,000 Indians, making it one of the more populated areas in the State. Generally, Indians in the Cache Creek Basin are classified as Pomo, Lake Miwok, and Patwin. Recent surveys within the Clear Lake-Cache Creek Basin have located 28 archeological sites, some of which appear to have considerable antiquity. A Patwin site 6 miles northwest of Clear Lake is on the National Register of Historic Places. Sites along Clear Lake Outlet Channel have not been excavated, but the Department of Anthropology of the University of California, Davis, has conducted limited test excavations in the foothills of Capay Valley. One large village on the right bank of Cache Creek has provided the oldest evidence of human occupation in Capay Valley, and a small portion of the site has been excavated.

White settlers entering the Clear Lake region between 1850 and 1855 displaced and disrupted much of Lake County's Indian population. In a short time, large portions of the valley became privately owned; agriculture, mining, and lumbering flourished; and resort businesses began around the many mineral springs. Lake County was officially organized in 1861, with Lakeport as the county seat.

Cache Creek in Yolo County is rich in historical lore and played a crucial role in the settlement and development of the region. The name Cache Creek came from the fur trappers "caching" their furs along the stream. Fur trapping was one of the earliest activities of white men, and in 1829 the first fur brigade in the Sacramento Valley camped at French Camp 1 mile east of Yolo on the north side of Cache Creek. The earliest permanent settlements were also established along Cache Creek. Yolo was one of California's original 27 counties in 1850, and the town of Yolo, originally called Cacheville, became the first county seat in 1857. From its beginning to the present, Yolo County's rich agricultural resources have dominated the county's history and expansion.

Human Resources and Economic Development

Out of 58 counties, Lake County ranks 41st and Yolo County 28th in California county populations. While there are no large urban developments in Lake County, those areas that are urbanized are located around the Clear Lake rim, where most of the population of the upper basin live. Lake County ranks first in California in percentage of population over age 65, and the current 5.7 percent growth rate is mostly from retirees 65 years or older. Birth rates in Lake County are lower than the average State rate because many young adults have migrated to metropolitan areas in search of employment and educational opportunities. From Memorial

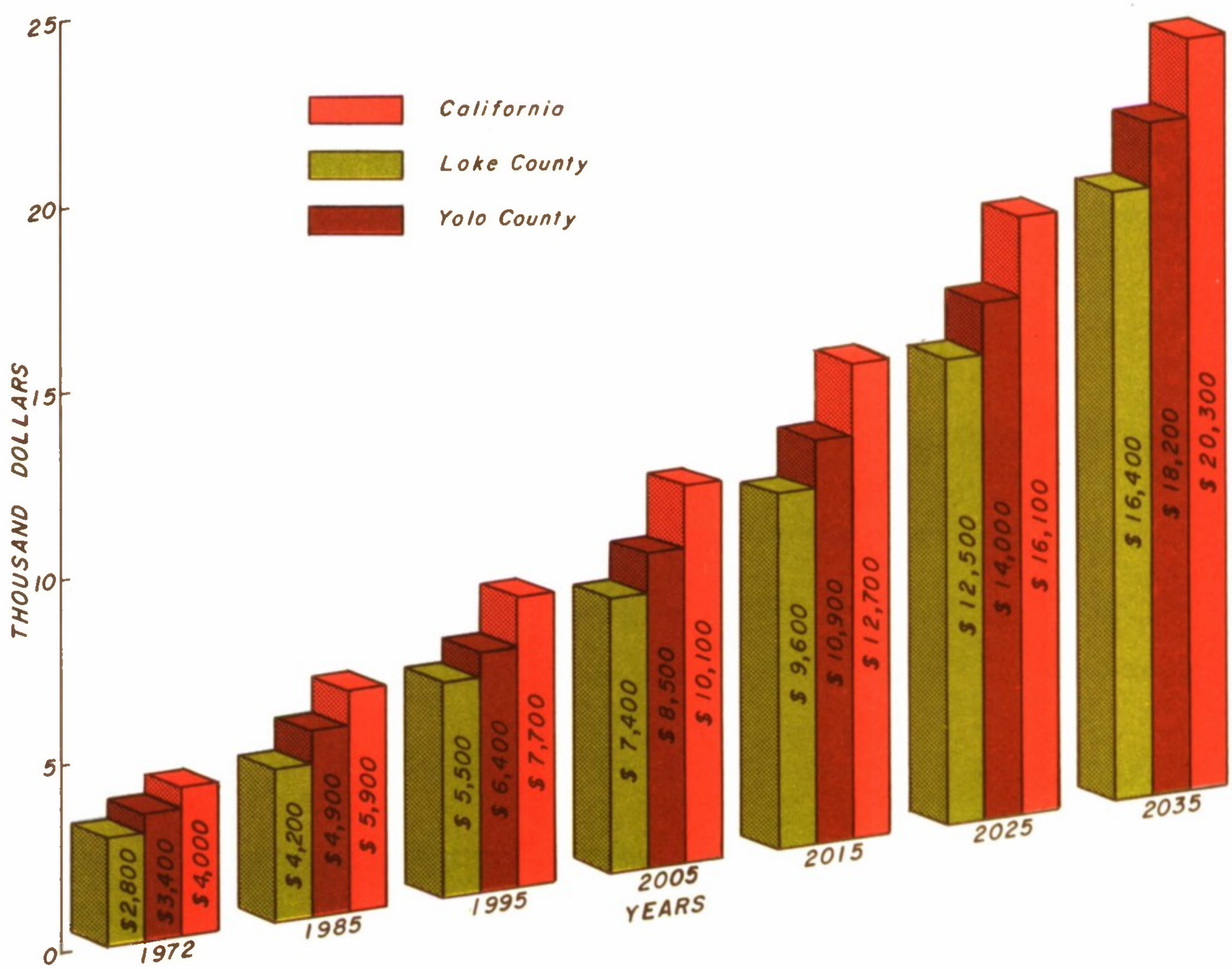
Day to Labor Day, the seasonal vacation population of about 80,000 exceeds the number of permanent residents (27,600). Over 55 percent of the housing units in Lake County are summer homes or cabins. Since there are no zoning restrictions in type of housing, lower quality homes are interspersed with expensive, higher quality homes, mobile homes, and semipermanent and vacation trailers.

Lake County depends on agriculture and trade and services jobs relating to summer recreation. Although commercial trade and services represent the largest source of employment, growth has been slow. Employment in agriculture and food processing has declined since 1950.

Yolo County had an estimated 1976 population of 104,700. Much of the recent population growth has been the result of inmigration into the incorporated areas of Woodland and Davis. Woodland, with an estimated population of 25,150 in 1974, is the only major population center partly in the Cache Creek Basin.

In the past 5 years, industry has expanded and diversified in Yolo County. However, since agriculture remains the most important influence on the labor market, seasonal unemployment is serious in rural areas during the winter. Unskilled workers generally are surplus throughout the year. Per capita personal income projections for California and Lake and Yolo Counties are shown on the following page.

City of Woodland with Interstate 5 in Foreground
January 1974

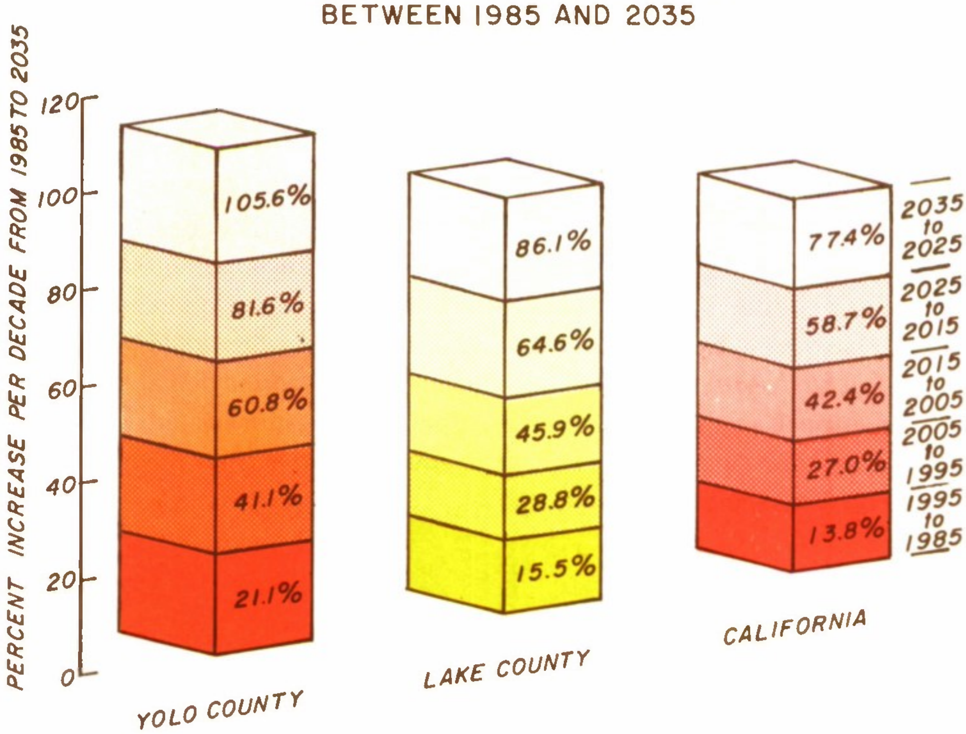


PER CAPITA PERSONAL INCOME PROJECTIONS
FOR CALIFORNIA AND LAKE AND YOLO COUNTIES
(1967 DOLLARS)

The population of Lake County is expected to increase from 27,600 in 1976 to 58,800 by 2035, representing a compound growth rate of about 1.71 percent per year, which is less than the historical rate of about 2.5 percent per year for the last 40 years. The population of Yolo County is expected to increase from 104,700 in 1976 to 273,900 by 2035, representing a compound growth rate of about 1.70 percent per year, which is much less than the historical rate of about 3.4 percent per year for the last 40 years. Rates of population growth in the urbanized and urbanizing areas of both counties are expected to differ from overall rates in the counties. Population growth along the perimeter of Clear Lake will be limited by space and basic service facilities, yet it is estimated that the perimeter will support more than twice the present population. The population of Woodland is expected to increase and follow the countywide trend of expansion away from the flood plain. Population projections for California and Lake and Yolo Counties are shown on the following page.

New Development near lower end of Clear Lake
MAY 1975

PROJECTED POPULATION GROWTH
BETWEEN 1985 AND 2035



Year	Yolo County	Lake County	California
1985	133,000	31,600	24,363,000
1995	161,100	36,500	27,726,000
2005	187,600	40,700	30,948,000
2015	213,900	46,100	34,705,000
2025	241,500	52,000	38,670,000
2035	273,900	58,800	43,226,000

Problems and Needs

Status of Existing Plans and Improvements

Problems and specific needs of Clear Lake and Cache Creek are summarized below, including the status of existing plans of various Federal and non-Federal agencies and improvements, as shown on plate 1, desired by local interests.

LAKEPORT LAKE

The Lakeport Lake project on Scotts Creek, in the upper portion of the basin, was authorized for construction by the Corps of Engineers by the Flood Control Act of 1965. The lake would have storage capacity of 55,000 acre-feet. The facility would be operated to provide flood control to downstream areas along Scotts Creek and incidental flood control to Clear Lake; a municipal and industrial water supply; an irrigation water supply; water-oriented recreation; and fish and wildlife enhancement. The project has recently been classified as deferred pending receipt of assurances.

MIDDLE CREEK

The Corps of Engineers constructed levees for flood control in the Middle Creek Basin. This project, the Middle Creek Improvement Project, authorized by the Flood Control Act of 1954, included levees and incidental channel improvements on Middle Creek, a channel for diversion of Clover Creek overflows to Middle Creek above the town of Upper Lake, levees on lower Scotts Creek, and pumps for discharge of drainage. The majority of these facilities were completed in November 1959.

LOWER CACHE CREEK

As part of the Sacramento River Flood Control Project, the Corps of Engineers in 1937 completed construction of the Cache Creek Settling Basin. The settling basin, located in Yolo County about 2 miles east of Woodland, is bounded by levees on all sides and covers approximately 3,600 acres. The basin's fundamental purpose is to preserve the floodway capacity of the Yolo Bypass by trapping sediment loads carried by Cache Creek during the flood season and preventing the sediment from depositing downstream in flood control and navigation channels. Since 1937 the sediment storage capacity has diminished, and sediment deposits have been partly controlled by readjusting the training levees to make best use of basin storage.

Also as part of the Sacramento River Flood Control Project, the Corps in 1943 modified the locally constructed Cache Creek levees to a design flow of 20,000 cubic feet per second (cfs); in 1950 training levees were modified to a design flow of 24,000 cfs; and in 1961 upstream levees were again modified to increase the design flow to 30,000 cfs.

SOIL CONSERVATION SERVICE

The Soil Conservation Service constructed two small dams, one on Adobe Creek and the other on its tributary, Highland Creek, to provide flood protection to the 4,000-acre flood plain along lower Adobe Creek.

LAKE COUNTY

Lake County, which is participating in the National Flood Insurance Program, has enacted ordinances to control and regulate land use and construction within the 100-year flood plain (land area inundated once per hundred years, on the average). The Corps of Engineers prepared flood insurance studies dated December 1971 and May 1972 for the Federal Insurance Administration (FIA) for the incorporated areas of Lake County and Lakeport, respectively. These studies have been updated and combined into an expanded study dated April 1976 which has been submitted to the FIA for approval.

YOLO COUNTY

The Indian Valley Reservoir on North Fork Cache Creek was constructed by the Yolo County Flood Control and Water Conservation District. The reservoir has a storage capacity of 300,000 acre-feet, of which 40,000 is for flood control storage, and provides irrigation water to agricultural lands in Yolo County. The District also owns and operates an irrigation system, including canals and other facilities, which provides water from Clear Lake to agricultural land in Yolo County.

Flood Problems

Floods in the Cache Creek Basin are principally caused by runoff of high-intensity rainstorms during winter and spring. Storms contributing to flooding have a pattern of peaks producing large quantities of water within short periods of time, and all record floods in the Cache Creek Basin have been rain floods characterized by these relatively high peaks. Since stream reaches are short and channel gradients steep, peak floodflows usually pass completely through the basin within 24-hour periods.

The effects of floods are different for the upper (Clear Lake) and lower (Cache Creek) portions of the basin. Around the Clear Lake shoreline flooding is caused primarily by inadequate discharge capability of the lake's 5-mile-long outlet channel, located between Clear Lake and the Clear Lake Dam, which discharges a maximum of about 8,000 cfs during an

extremely rare flood event (lake stage of about 14.5 feet). Since historical flood inflows into the lake have at times exceeded 40,000 cfs, floodwater must be stored temporarily in the lake thereby causing flooding along the shoreline. The Clear Lake Dam, built in 1915, has not affected the channel discharge capacity, but the Grigsby Riffle, a natural geological obstruction in the Clear Lake Outlet Channel, restricts flow from the lake to the dam. Clear Lake Dam, which is currently operated by Yolo County for flood control and water supply, is capable of discharging much larger flows than have historically been released. In 1977, the State of California investigated the safety of the dam and determined that the dam was structurally adequate for full operation and the spillway could pass the 1- in 1,000-year event (24,900 cfs) with adequate freeboard (2.5 feet).

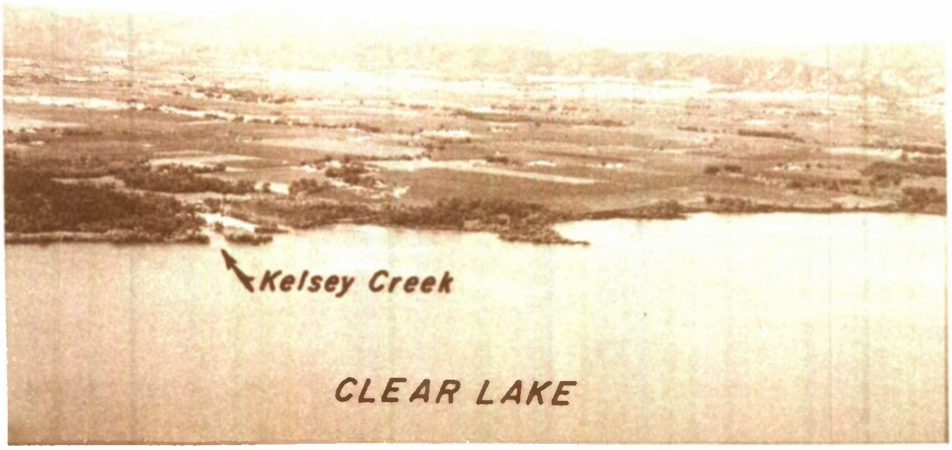
Enlargement of the Clear Lake Outlet Channel is prohibited by the Gopcevic (1920) and Bemmerly (1940) Decrees. The Gopcevic Decree stipulated a minimum (zero feet at the Rumsey gage at Lakeport which is 1318.65 feet, m.s.l. datum) and maximum (7.56 feet) lake level within which Yolo County must operate for irrigation and also prohibited any alteration of the outlet channel except when necessary to carry out provisions of the decree. The decree stemmed from a suit by various private individuals and companies against the then-named Yolo Water and Power Company, which was pumping water out of Clear Lake into the outlet channel to satisfy downstream water users; this pumping, along with the drought years of 1919-1920, caused docks and other recreation-oriented facilities to be left out of the water and agricultural operations to be damaged.

The Gopcevic Decree was a compromise between individuals wanting a high lake level to insure recreation would not be impeded and those preferring a low lake level which they believed helped to prevent periodic flood damages around the lake. However, the decree has had minimal effect in controlling flooding on the Clear Lake perimeter. Although a lake stage between 7.56 and 9.0 is allowed for temporarily storing floodwater for no more than 10 consecutive days, these levels and days were exceeded most recently in 1958 and 1970. During the flood of 1958, the elevation of Clear Lake reached a maximum of 10.88 feet; exceeded 9.0 feet for 44 days (while the maximum possible release was being made from the lake); and exceeded 7.56 feet for 82 consecutive days. At that time, 4,000 acres of residential, commercial, and agricultural lands adjacent to Clear Lake were flooded an average of about 2 feet, and water remained in many homes and businesses for as long as 2 months. Damages were estimated at $878,000. In the flood of 1970, the lake reached a stage of 10.47 feet; exceeded 9.0 feet for 16 days; and exceeded 7.56 feet for 44 consecutive days. About 1,600 acres around the lake's rim were flooded, causing about $485,000 in damages. Records of water surface elevations in Clear Lake since 1874 show that elevation 7.56 has been exceeded 44 times and elevation 9.0 has been exceeded 24 times.

After severe flooding in 1937-38 around Clear Lake, Lake County appealed to the State of California for relief. Subsequently, the Clear Lake Outlet Channel was excavated to increase the capacity of the channel, but in April 1938 downstream property owners in Yolo County brought suit against Lake County, the State of California, and the Clear Lake Water Company complaining that increased flows out of Clear Lake, made possible by the enlarged outlet channel, added to the already present flood problems downstream. In 1940 the Bemmerly Decree permanently restricted any further excavation in the outlet channel.

Community of Lakeport
with State Highway 29 in Background
May 1975

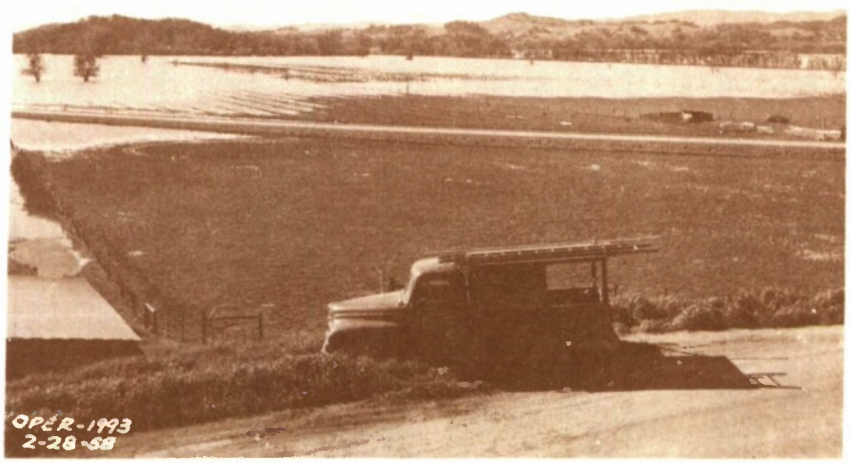
Inundation of Anderson Marsh and
Clear Lake Outlet Channel at Lake Stage 10.34 Feet (No Wind)
January 1970



Agricultural Development Adjacent to
Northwestern End of Clear Lake
May 1975

Inundation of Agricultural Land
at Lake Stage 10.34 Feet (No Wind)
January 1970

Flooding of Highways and Residential Development
Clear Lake Rim
February 1958

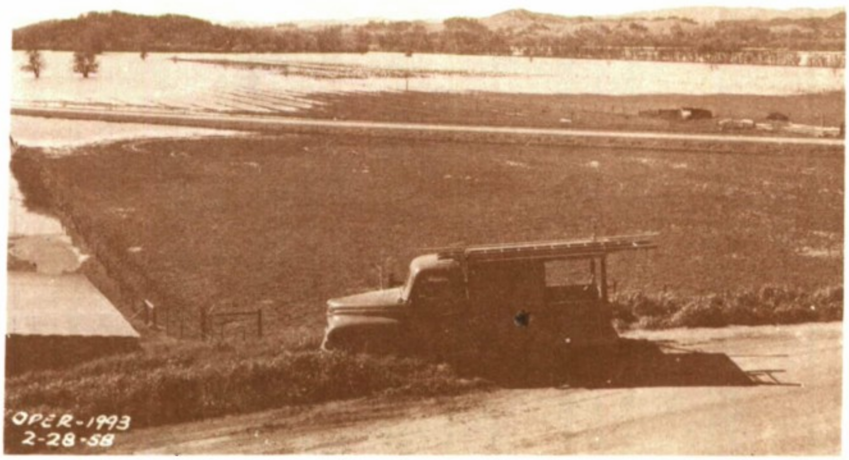


Flooding of Highways and Agricultural Land
Clear Lake Rim
February 1958

Flooding of Residential Development
Clear Lake Rim
January 1970

Flooding of Residential Development
Clear Lake Rim
January 1970

Flooding of Highways and Residential Development
Clear Lake Rim
February 1958



Flooding of Highways and Agricultural Land
Clear Lake Rim
February 1958

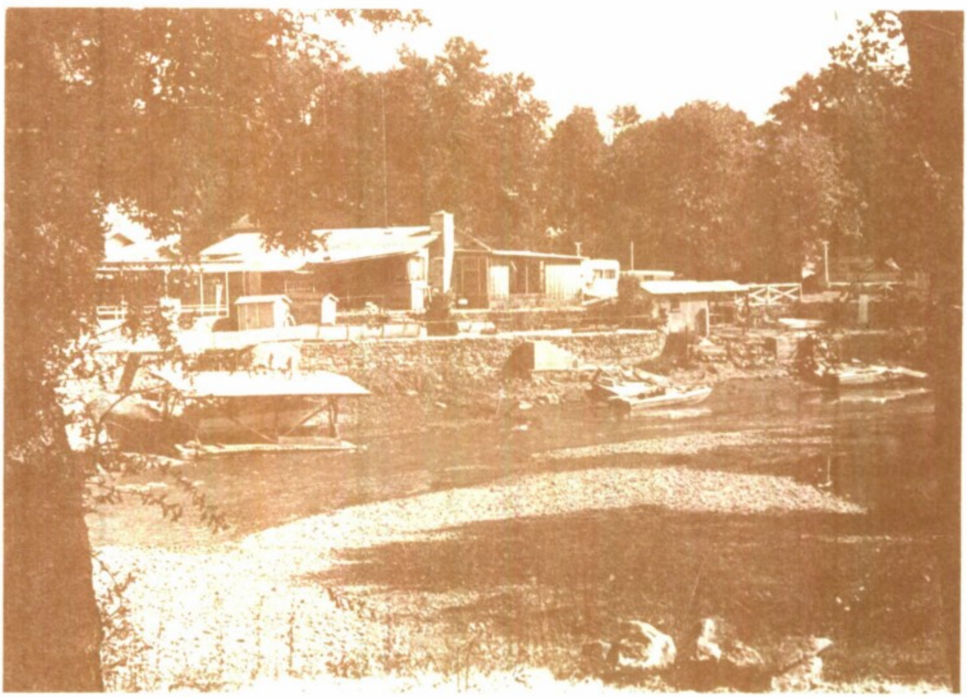
Flooding of Residential Development
Clear Lake Rim
January 1970

Flooding of Residential Development
Clear Lake Rim
January 1970

Flooding Along Highway 29,
3 Miles North of Lakeport
30 January 1970

Flooding Along Highway 29 Near Lakeport
30 January 1970

Clear Lake Dam
August 1973



Typical Development Along Clear Lake Outlet Channel
(Non-Typical Low Flows Are Due to Upstream Repair Work
Which Required Diversion of Water)
October 1973
(Photo Courtesy of Woodland Daily Democrat)

Clear Lake acts as a regulating reservoir to modify the large quantities of water flowing to the lower Cache Creek area; nevertheless, the area below Clear Lake along Cache Creek is subject to flooding.

The design capacity of the Cache Creek levees downstream of Yolo was increased from 24,000 to 30,000 cfs in 1961. A levee break in 1956 caused 700 acres to be flooded. Although successfully holding a peak flow of 41,400 cfs in February 1958, the levees were under constant surveillance, and critical areas were sandbagged to prevent major flooding. At that time Cache Creek overflowed its banks upstream and flooded farmlands and roads. For the 1958 flood, flood damages along Cache Creek above the leveed reach and below Clear Lake were estimated at about $520,000. In 1970 limited flooding in the lower basin adjacent to Cache Creek caused approximately $50,000 in agricultural damages. Average annual damages expected to occur in Cache Creek Basin are tabulated below.

AVERAGE ANNUAL DAMAGES - 1977 CONDITIONS

Location*	Average Annual Damage
Clear Lake Rim	$1,339,000
Cache Creek	
Reach 1 (Rumsey to Capay Weir)	34,200
Reach 2 (Capay Weir to Airport Road)	30,500
Reach 3 (Airport Road to Settling Basin)	65,000

*See plate 1. (Airport Road is also called County Road 94B. Highway structure crossing Cache Creek is called Stevens Bridge.)

Erosion and Sediment Problems

BANK EROSION

Banks have eroded along Cache Creek between the towns of Rumsey and Yolo, and erosion damages are primarily evident along the right bank where agriculture has developed. In the reach between Capay and Yolo, banks have been lost because of erosion and mining sand and gravel from the channel and bordering lands. In particular, gravel mining downstream of Stevens Bridge has significantly widened the channel.

SEDIMENT

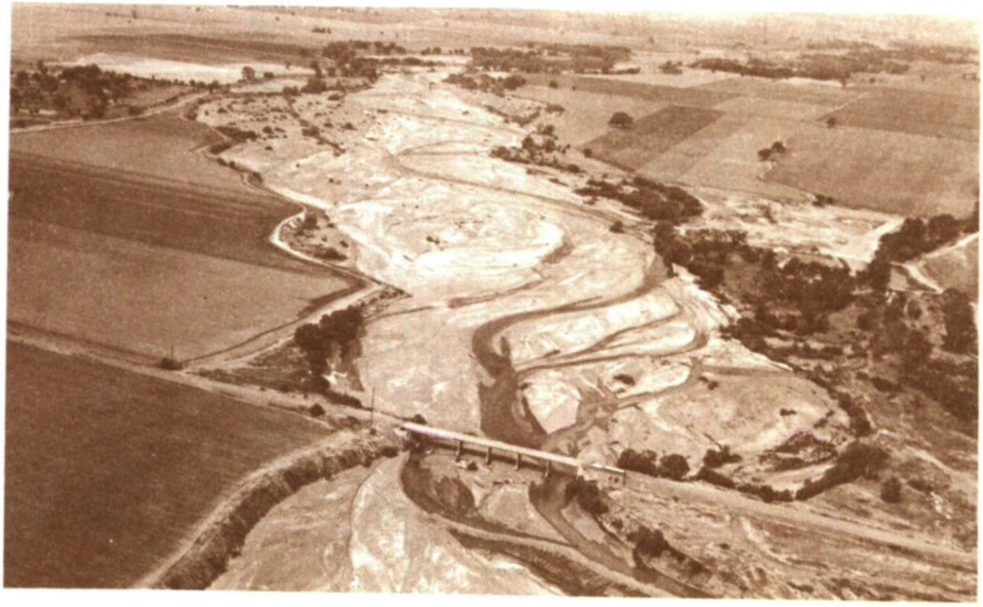
Hillside and sheet erosion in the Capay Valley above Capay is the major source of sediment transported by Cache Creek. The sediment yield in the Capay Valley between Rumsey and Capay is approximately 3.5 times higher than in the upstream portions of Cache Creek

Basin. Sediment transported to the Cache Creek Settling Basin amounts to an average of 675 acre-feet annually (about 1.2 million cubic yards). In 1937 the Cache Creek Settling Basin was constructed as a unit of the Sacramento River Flood Control Project to maintain the floodflow capacity of the Yolo Bypass by controlling sediment deposition. However, sedimentation in the Yolo Bypass from Cache Creek has again become a problem because the storage capacity of the settling basin is now depleted. Deposition in the settling basin is shown in the following tabulation and in the foldout sketch following page 26.

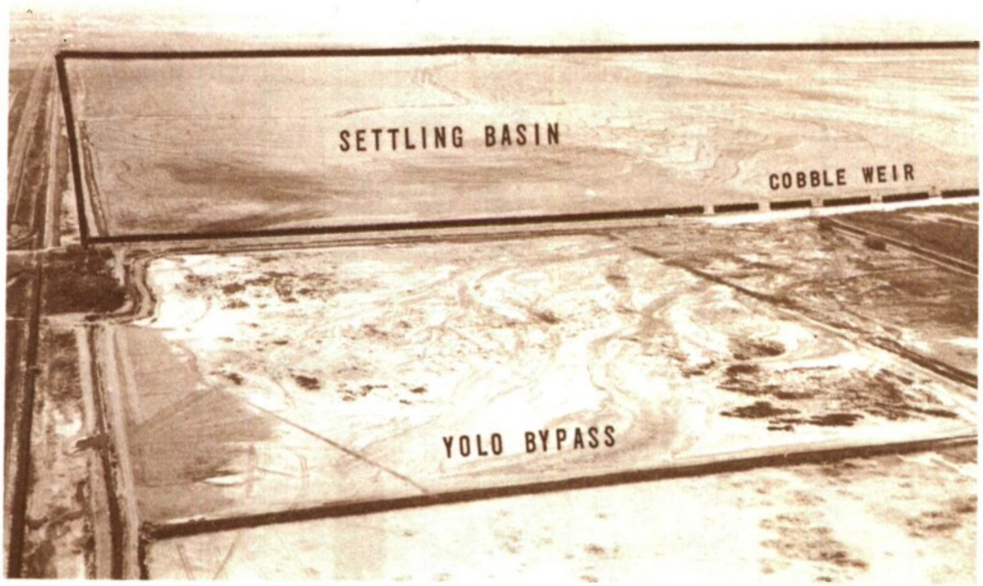
DEPOSITION IN SETTLING BASIN

Period	Acre-Feet
1937 to 1958	9,700
1958 to 1968	1,900
1968 to 1971	1,035
Total	12,635

Typical Highly-Erosive Bank
of Cache Creek in Upper Capay Valley
December 1971



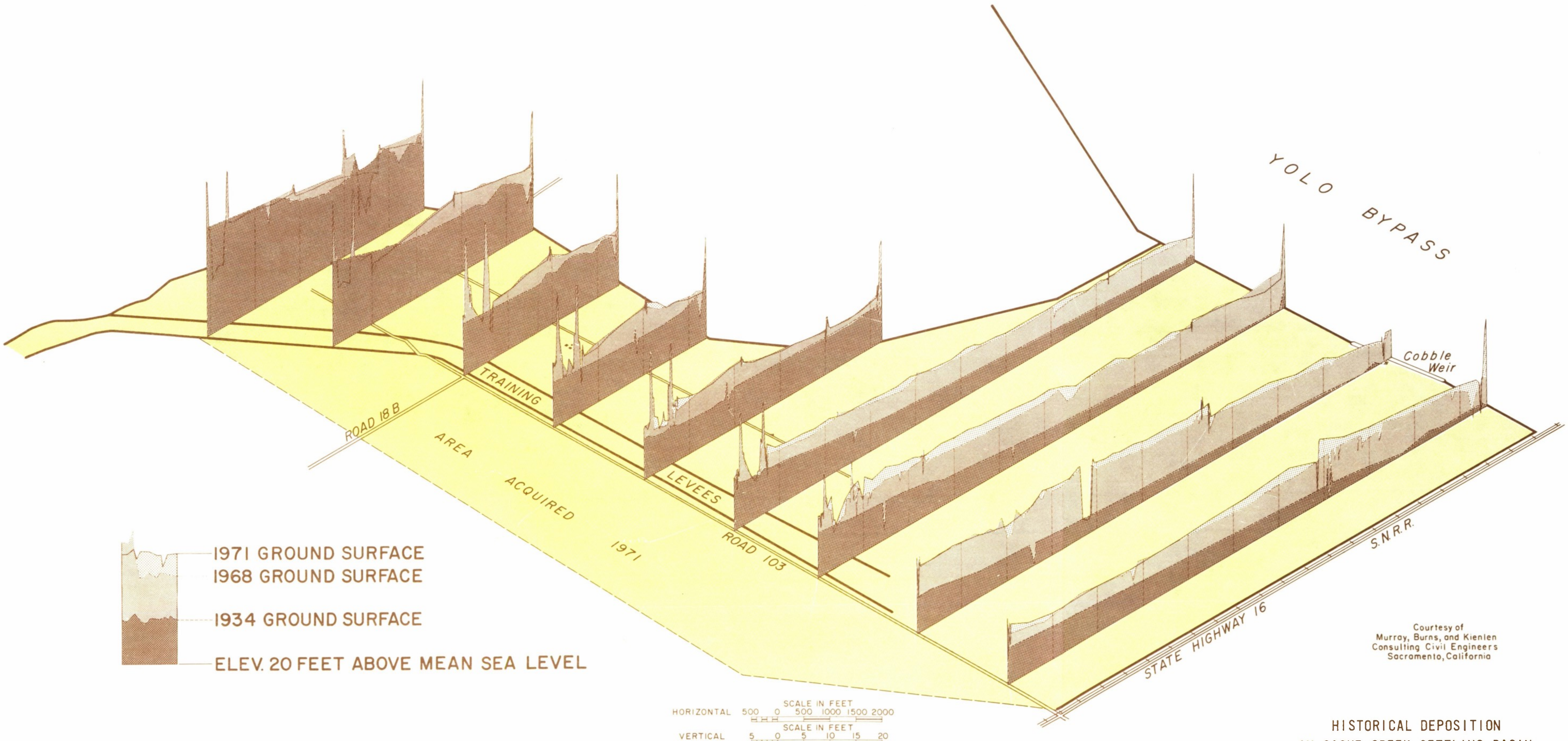
Meandering Cache Creek Channel Through Lower Capay Valley,
County Road 94B and Stevens Bridge in Foreground
May 1975



Cache Creek Settling Basin in Background,
Yolo Bypass in Foreground
May 1975

Gravel Mining Operation Within
Lower Cache Creek Channel
May 1975

Moore Diversion Dam Conveying
Water Westerly for Irrigation in
Yolo County
May 1975



HISTORICAL DEPOSITION
IN CACHE CREEK SETTLING BASIN

Interim measures to increase the storage capacity, including raising the Cobble Weir at the outlet of the settling basin and manipulating the training levees, have prolonged the settling basin's efficiency in trapping sediment. With the depletion of storage space in the settling basin, Cache Creek's heavy sediment load is being carried into the Yolo Bypass unimpaired, affecting the bypass floodflow capacity. Also, additional sediment flows downstream, compounding the sediment deposition problems in flood control and navigation channels such as the Sacramento River Deep Water Ship Channel and San Francisco Bay system. About 11 million cubic yards is annually dredged from these critical problem areas. If no action is taken, an estimated 340 acre-feet annually (550,000 cubic yards) of sediment that formerly deposited in the settling basin will flow into the bypass with about 240 acre-feet depositing in the lower bypass, navigation channels, and the San Francisco Bay system.

Municipal and Industrial Water Supply Needs

LAKE COUNTY

Ground water is the major source of municipal and industrial (M&I) water supply in the vicinity of Clear Lake, but some water supply is also provided by the lake. The Corps authorized Lakeport Lake project, currently deferred due to lack of local assurances, would supplement the M&I water supply by providing an additional 8,400 acre-feet annually to the Lakeport area. Pomo Reservoir on Kelsey Creek, being studied by Lake County, also would supplement M&I water supply of the Clear Lake area.

YOLO COUNTY

The larger cities in Yolo County, such as Woodland, Davis, and Winters, obtain their entire water supply from ground water, and it is predicted that wells will continue to be used for M&I water supply in the future.

Irrigation Needs

LAKE COUNTY

Although within Lake County, Clear Lake provides only a limited source of irrigation water for Lake County, since Yolo County Flood Control and Water Conservation District owns most of the rights to water stored in the lake. As set forth in the 1920 Gopcevic Decree, Yolo County has use of Clear Lake water for irrigation purposes between the stages of zero and 7.56 feet on the Rumsey gage at Lakeport. However, in utilizing this water, evaporation and other losses must be considered. Irrigation water supplies can be developed on the streams flowing into the lake. The authorized Lakeport Lake project on Scotts Creek could provide 9,100 acre-feet annually of irrigation water. Also, as previously discussed, Pomo Reservoir would furnish irrigation water to the Big Valley area adjacent to Kelsey and Adobe Creeks.

YOLO COUNTY

Yolo County is primarily an agricultural county, and water for agriculture is obtained from ground and surface water supplies. Clear Lake, Indian Valley Reservoir, Cache Creek, and the Sacramento River are the primary sources of surface water. Recent studies indicate that combined sources of surface and ground water are nearly sufficient to meet demands. However, more water will be needed to irrigate land not presently used for agriculture.

Water Quality Problems

CLEAR LAKE

The most significant water quality problem in Clear Lake is the excessive algal growth caused by the rich nutrient content of the lake. When wind-swept to the shoreline, the algae die, producing an unsightly appearance and giving off an unpleasant odor to the detriment of recreation, which is one of the major beneficial uses of the lake. Irrigation water for downstream users, the second major beneficial use of Clear Lake, is satisfactory for the crops grown.

The Clear Lake Algal Research Unit (CLARU) has conducted rigorous studies and tests on the causes and control of algal blooms in Clear Lake and has attempted to find a means to "tip the ecological balance" so that the growth of nonobnoxious green algae is favored over the growth of the obnoxious blue-green algae.

CACHE CREEK

The major beneficial use of Cache Creek is irrigation water supply. Currently, the water of Cache Creek as it leaves Lower Arm of Clear Lake is a suitable quality to satisfy downstream irrigation uses. Downstream of Clear Lake Dam, Bear Creek, which flows into Cache Creek, has a relatively high boron content, so crops irrigated with lower Cache Creek water have to be insensitive to the boron concentrations. Other beneficial uses of Cache Creek, such as fishery and recreation, are satisfactorily met by the present water quality.

Fish and Wildlife Needs

The California Department of Fish and Game in its report on "The Fish and Wildlife Resources of Anderson Marsh, Clear Lake, Lake County," dated January 1974, concluded that Anderson Marsh and other associated wetlands are vital segments in Clear Lake's natural resource production, maintenance, and perpetuation. These resources will be further jeopardized if reduced or committed to nonresource use. Fish and Game has been attempting

to preserve a wildlife area adjacent to the lake and is considering purchase of the Anderson Ranch, a portion of which is a natural marsh area, and development of a wildlife refuge.

Clear Lake is widely known as an excellent fishery for warmwater species of fish, and the Clear Lake area is inhabited by many species of wildlife. Cache Creek and its tributaries provide minor fisheries for smallmouth bass and white catfish.

At the mouth of Cache Creek, the settling basin currently contains some lands that are not used for agriculture, thereby allowing maximum use for wildlife. However, the U.S. Fish and Wildlife Service and Department of Fish and Game are concerned that the amount of unused land is continually diminishing.

General Recreation Needs

About 39 miles of Clear Lake's 100-mile shoreline has been intensively developed for water-associated recreation, including lakeside residences, public and private beaches, and wharfs. Because the Clear Lake Water Company operates Clear Lake to obtain a water supply for agriculture, the lake is drawn down during the late summer. During years of low inflow to the lake, this lowering of the lake level is considered a detriment by recreation interests. As discussed in "Water Quality Problems," another major detriment to recreation is the growth of blue-green algae in Clear Lake.

At present little recreational use is made of the main stem of Cache Creek or of its tributaries; however, whitewater boating on North Fork Cache Creek and Cache Creek has grown in popularity. Adjacent lands are used for limited deer and quail hunting.

Improvements Desired

At the public meeting held in Woodland on 2 July 1969, local interests expressed their desires for improvements varying from channel stabilization to multipurpose storage reservoirs and restriction of aggregate mining from portions of Cache Creek. The Reclamation Board of the State of California, which maintains and operates the Sacramento River Flood Control Project, desires a long-range solution to the settling basin problem to prevent sediment deposition from reducing the flood-carrying capacity of the Yolo Bypass. Lake and Yolo County water agencies indicate a need for additional irrigation water supply in both the upper and lower basins to supplement diminishing ground water supplies. Lake County officials would like to have the water quality improved and the lake level stabilized to enhance recreation potential and control flooding of the lake perimeter.

At the public meetings held 2 and 4 December 1975, the Reclamation Board favored further detailed studies of flood control alternatives involving enlargement of the Clear Lake Outlet Channel and construction of an adjacent bypass channel; and supported further studies of any plan to (a) raise and enlarge the levees of the settling basin, or (b) excavate material from the basin, or (c) expand the basin, or (d) a combination of any of these plans which will provide a good feasible solution to the sedimentation problem. Lake County indicated by letter dated 22 December 1975 that the recreation features shown at the public meeting, consisting of campgrounds and associated facilities and improved access along the outlet channel and to Garner Island, should not be included in the project. The primary objection to recreation development as part of a Federal project was that it would compete with such development by local interests. Yolo County has voiced no objection to development of recreation facilities in lower Cache Creek Basin.

Formulating the Plans

The plan formulation process used in selecting a plan is described in this section. Formulation and evaluation criteria are outlined, the two main problem areas are discussed, and the 19 alternative solutions are identified and described. Also, the subsection "Selecting the Plans" briefly describes the two best plans and the reasons for their selection.

Formulation and Evaluation Criteria

The alternative plans of improvement were formulated and evaluated based on their technical, economic, environmental, and socioeconomic impacts on the Clear Lake-Cache Creek areas. Plan formulation criteria include the Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources" (P&S), dated 10 September 1973, and implementing regulations developed by the Corps of Engineers.

TECHNICAL CRITERIA

The following criteria were adopted in developing the plans:

a. The plans should be consistent with the California Water Plan and the General Plans for Lake and Yolo Counties.

b. Provisions should be made for drainage of lands adjacent to proposed levees.

c. Plans developed should be consistent with provisions of the National Flood Insurance Program.

d. During the flood season, the storage of Clear Lake should be controlled, to the maximum extent possible, to the current nondamaging level of 7.56 feet on the Rumsey gage at Lakeport. The nondamaging Cache Creek flow of 20,000 cfs at the downstream community of Rumsey should be a factor in determining operation of Clear Lake for flood control.

e. Clear Lake should be operated so that the existing water rights are preserved.

f. Historical sediment flow and deposition should be used as a basis for future storage requirements.

g. Sediment control life should be as long as possible, considering constraints of physical practicality and economic feasibility.

h. At least 50 percent sediment trap efficiency should be provided since historically this degree of trap efficiency has permitted adequate control of the Cache Creek sediment flow.

i. Flood control evaluations should be conducted assuming the authorized Lakeport Lake project would not be in operation. This assumption is consistent with recent reclassification of the Lakeport Lake project to "deferred" status.

ECONOMIC CRITERIA

Economic criteria for formulation of the plans are summarized as follows:

a. The benefits and costs should be expressed in comparable terms as fully as possible. All evaluations of alternatives should be based on October 1977 prices, an interest rate of 6⅝ percent, and 100- and 50-year project lives for flood control and sediment control alternatives, respectively.

b. Each alternative considered in detail must be "justified" in the sense that total beneficial effects (monetary and nonmonetary) associated with the objectives are equal to or exceed the total adverse effects (monetary and nonmonetary) associated with the objectives.

c. The selected plans must have net national economic benefits unless the deficiency in net benefits incurred is associated with attaining environmental quality objectives.

d. The size of the flood control project selected should be based on providing the maximum net benefits; however, environmental quality and intangible considerations could dictate a project larger or smaller in size which would forego some of the net tangible benefits.

e. Project benefits should be based on analysis of conditions without and with a project, using methodology described in P&S and Corps of Engineers regulations.

ENVIRONMENTAL CRITERIA

The following environmental criteria are applicable to the formulation and evaluation of plans:

a. Plans should be formulated to the extent practicable to preserve and enhance the quality of the natural environment, specifically including fish and wildlife, vegetation, land, air, water, open space, and scenic and esthetic values.

b. Detrimental environmental effects should be avoided where possible, and feasible mitigation for unavoidable effects should be included.

c. The relationship of the proposed action to land use plans should be considered, and the environmental impact of any proposed action should be evaluated. Any adverse environmental effects which could not be avoided, if a proposal were implemented, should be delineated; alternatives to such proposed action should be identified; the relationship between local short-term uses and the maintenance or enhancement of long-term productivity should be determined; and any irreversible and irretrievable commitments of resources involved if a proposed action were implemented should be identified.

SOCIOECONOMIC CRITERIA

The following socioeconomic criteria are applicable in this study:

a. Consideration should be given to evaluating and preserving historical, archeological, and other cultural resources.

b. Consideration should be given to safety, health, community cohesion, and social well-being.

c. Displacement of people should be minimized to the extent practicable.

d. Improvement of leisure activities and public facilities should be evaluated.

e. Effects of a project on regional development, including income, employment, business and industrial activity, population distribution, and desirable community growth, should be considered.

f. General public acceptance of possible plans should be determined by coordination with interested Federal and non-Federal agencies, various groups, and individuals by means of public meetings, field inspections, informal meetings, letters, and other public involvement procedures.

g. The plans should be workable within the constraints of present and potential governmental structure function, relationships, and associations in the study area.

Possible Solutions

For evaluation purposes the alternative plans developed for the Cache Creek Basin are divided into two main categories: (1) flood control in the upper basin (Clear Lake) and (2) sediment control in the lower basin (Cache Creek).

UPPER BASIN (Clear Lake)

As previously stated, in the upper basin, flooding on the rim of Clear Lake generally occurs when inflow to the lake greatly exceeds the discharge capability of the Clear Lake Outlet Channel for long periods of time. Because most of the inflow must be stored in the lake, adjacent developments are damaged when the lake level rises. This problem could be resolved by (1) flood proofing existing development and regulating future growth in the flood plain; (2) controlling inflow to the lake; or (3) increasing outflow from the lake.

Since adequate control of inflow to Clear Lake was determined to be economically infeasible, flood control measures studied were then limited to (1) nonstructural alternatives such as flood proofing and (2) enlargement of the Clear Lake Outlet Channel to increase outflow. Nonstructural alternatives, such as evacuating the flood plain and placing floodwalls around or elevating structures to protect against flooding, were considered economically impractical due to excessive costs as compared to benefits derived. Before the Clear Lake Outlet Channel may be enlarged, two legal decrees, the Gopcevic Decree of 1920 and the Bemmerly Decree of 1940, must be modified. The Gopcevic Decree of 1920 culminated from a suit by private individuals against the then-named Yolo Water and Power Company, which was pumping water out of Clear Lake to downstream water users. This pumping, along with the drought years of 1919-1920, caused damages to agricultural operations and also caused damages by leaving docks and other recreation-oriented facilities out of the water. However, some individuals contended that a low lake level prevented periodic flood damages around the lake and was, therefore, preferable. The Gopcevic Decree was a compromise which stipulated a minimum and maximum lake level within which Yolo County was required to operate for irrigation and prohibited any alteration of the outlet channel except that necessary to carry out the provisions of the decree. After severe flooding in 1937-38 around Clear Lake, Lake County

appealed to the State of California for assistance. Channel excavation was begun to increase the capacity of the Clear Lake Outlet Channel, but in April 1938 downstream property owners in Yolo County complained that the increased flows out of Clear Lake, made possible by enlarging the outlet channel, would add to the already present flood problems downstream from Rumsey to Capay (because of in-channel gravel mining, flooding is no longer a problem from Capay to the project levees). In 1940 the Bemmerly Decree permanently enjoined the State of California, Lake County, and the Clear Lake Water Company from any additional excavation in the outlet channel, and in 1942 this decree was appealed and upheld. The Gopcevic Decree prohibits a lake level below zero feet on the Rumsey gage at Lakeport (1318.65 feet, m.s.l. datum) or above 7.56 feet, except for the temporary storage of floodwaters for not more than 10 days, when the lake stage may increase to 9.0 feet. However, the floods of 1958 and 1970 demonstrated that these requirements are unrealistic. In 1958 the elevation of Clear Lake reached a maximum of 10.88 feet, exceeded 9.0 feet for 43 days, and exceeded 7.56 feet for 82 consecutive days. In 1970 the lake reached a stage of 10.47 feet, exceeded 9.0 feet for 16 days, and exceeded 7.56 feet for 44 consecutive days. These violations of the Gopcevic Decree could have been prevented if the outlet channel had been enlarged, but such enlargement is specifically prohibited by the Bemmerly Decree.

LOWER BASIN (Cache Creek)

In the lower Cache Creek Basin, overbank flood damage potential is minor because extensive channel excavations by gravel operators have increased the channel capacity. However, about 1 million cubic yards of sediment are transported annually by Cache Creek downstream to its mouth; consequently, the sediment control alternatives address the adverse impact on the Yolo Bypass floodflow capacity from deposition of Cache Creek sediments in the bypass. Additionally, sediment flowing into the Yolo Bypass poses a threat of continuing downstream and depositing in the Sacramento River shipping channels and San Francisco Bay, with subsequent costly dredging required.

The sediment problem on Cache Creek can be controlled by (1) stabilizing the sediment source to prevent sediment inflow to the stream; (2) trapping the sediment at upstream locations closer to its source; or (3) providing additional sediment storage capacity in the downstream areas.

Preventing sediment from initially entering the stream would require planting, irrigation, and slope stabilization of widely distributed land areas, but Corps studies have shown this method of sediment control to be economically infeasible because of the vast area that would have to be modified. Further, such an attempt to control sediment inflow to Cache Creek would be impracticable due to the steep terrain involved. Therefore, the alternatives investigated were limited to those methods that would cause sediment to be trapped at some location upstream of the Yolo Bypass but within Cache Creek. Currently, this function is performed by the Cache

Creek Settling Basin, which is located adjacent to the Yolo Bypass. However, the settling basin, built in 1937, has nearly lived its useful life and now intercepts only a small portion of the over 1 million plus cubic yards of sediment that, on the average, flow into the settling basin. Acquiring additional land to construct new settling basins is not desirable because such a solution would be only temporary.

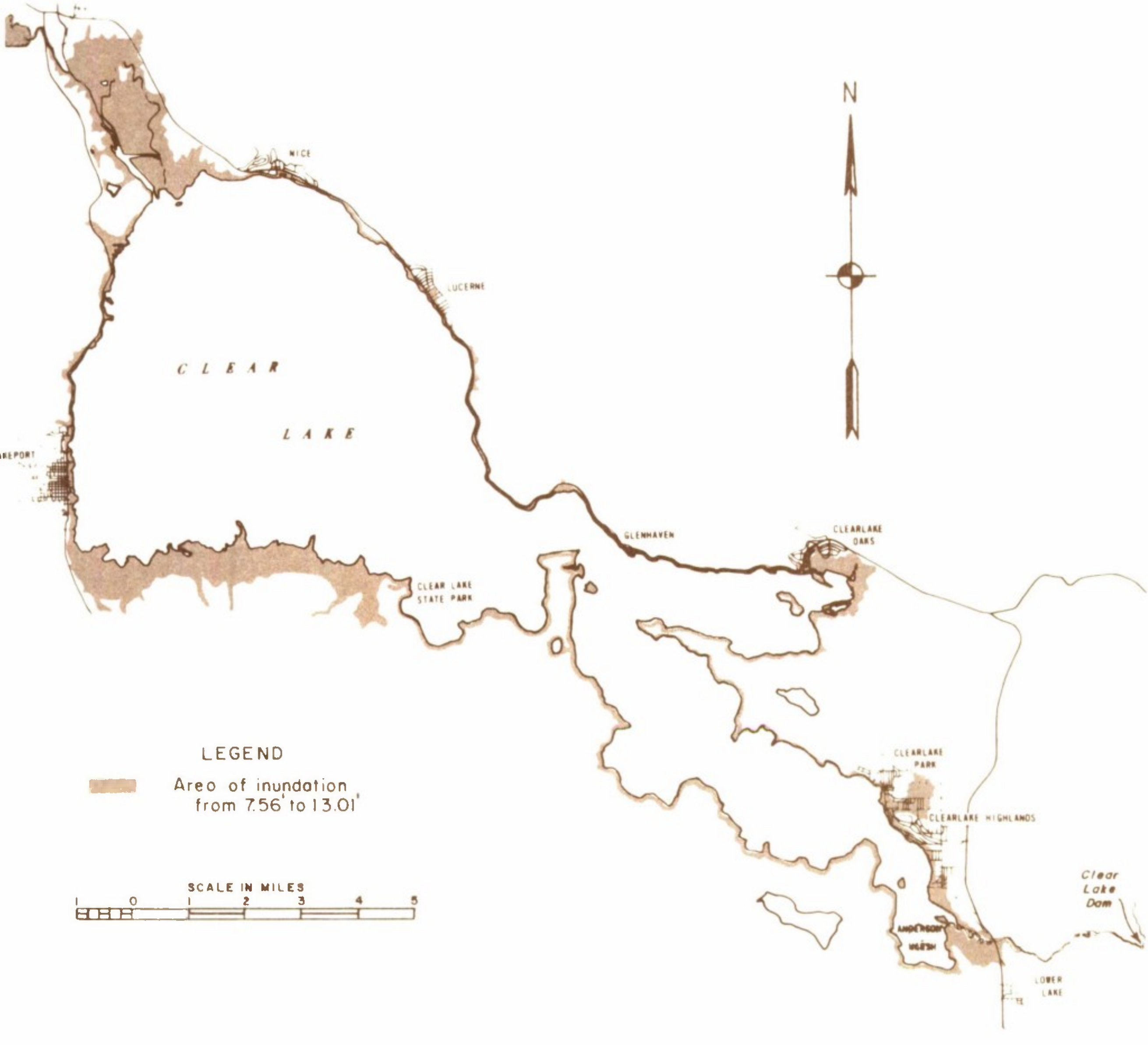
The alternative solutions considered to alleviate flood and sediment control problems of the Clear Lake-Cache Creek area are described below.

UPPER BASIN (Clear Lake)

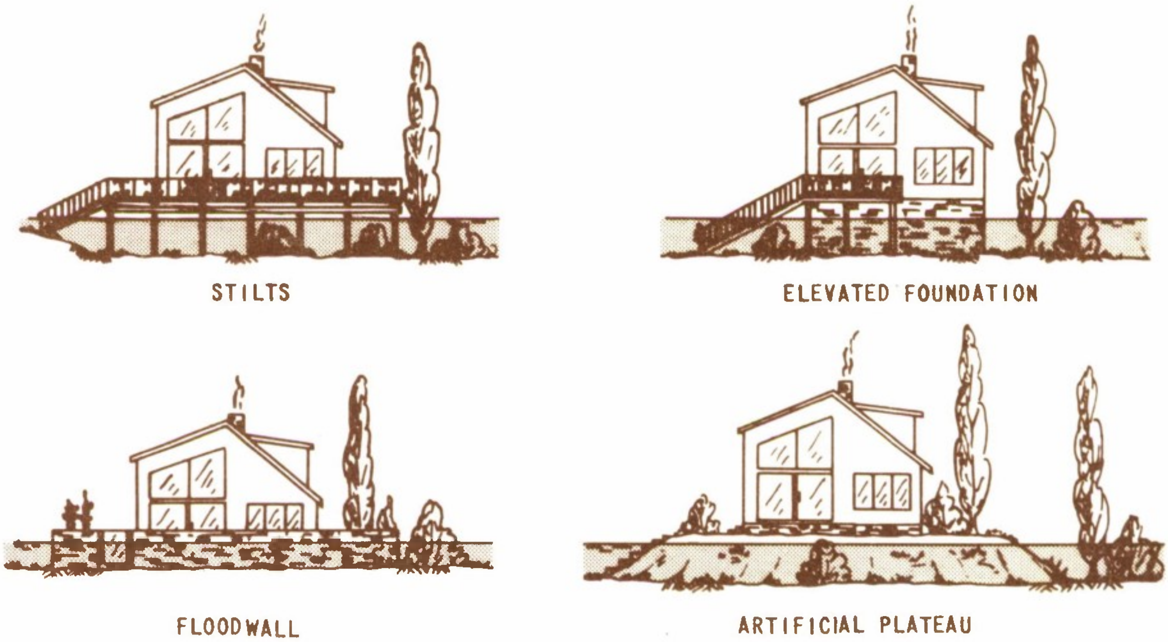
Plan 1 - No Action. - (The "no action" alternative is not considered viable because the serious flood problem on the Clear Lake rim would not be alleviated. Nevertheless, this alternative is discussed further in the "Alternatives Considered Further" subsection in order to compare the effect of proposed plans to conditions expected to occur with no Federal participation.)

Plan 2 - Flood Forecasting. - Currently, the joint Federal-State River Forecasting Center in Sacramento monitors weather conditions and lake and stream stages in the upper basin. This forecasting provides sufficient warning of impending danger, and modification of the system is not warranted.

Plan 3 - Evacuation of the Flood Plain. - By evacuating all structural development from the flood plain, about $1.2 million in flood damages would annually be prevented. However, Clear Lake rim damageable property valued at about $43.7 million, amortized over 100 years, would total $2.9 million annually. Since this cost, which does not include such items as real estate, utilities, and relocation costs, exceeds benefits which could be derived, this alternative was considered economically impractical and was not considered further. Shown below is the area of inundation between the nondamaging Clear Lake stage of 7.56 feet and the preproject Standard Project Flood plain elevation of 13.01 feet.



Plan 4 - Flood Proofing Existing Facilities. - Flood proofing measures include elevating or placing floodwalls around structures. However, because flood proofing all existing facilities in the flood plain would cost in excess of $1.5 million annually, while damages prevented would total about $1.2 million annually, this plan would not be economically viable and was therefore not considered further.



METHODS OF FLOOD PROOFING

Plan 5 - Flood Proofing Future Facilities. - (Flood proofing future development is considered economically feasible and is, therefore, discussed in the "Alternatives Considered Further" subsection.)

Plan 6 - Reservoir Storage on Tributaries. - Numerous storage reservoirs would be necessary to adequately reduce flooding on Clear Lake. The cost of such a reservoir system would greatly exceed benefits; for example, the first cost of 40,000 acre-feet of flood control space on Kelsey Creek would exceed \$30 million. Average annual costs would total about \$1.6 million. However, average annual equivalent damages on Clear Lake rim total only \$1.35 million, which is less than the cost to provide 40,000 acre-feet of flood control storage. Additionally, at least 100,000 acre-feet of storage is needed to provide a reasonable degree of flood protection to the Clear Lake periphery. Therefore, this plan was not considered further.

Plan 7 - Modify Operation of Clear Lake for Flood Control. - With this plan, the filling curve for Clear Lake would be revised so that the lake would not be allowed to fill until later in the spring. However, since recreation-oriented development on the lake rim depends on high summertime lake stages and agricultural concerns downstream in Yolo County depend on irrigation water supply, modification of existing lake levels for flood control is not supported by local interests. Also, such modification would be in violation of water rights agreements between Lake and Yolo Counties. These agreements would be difficult to modify in the interest of flood control; therefore, this plan was not considered further.

Plan 8 - Clear Lake Outlet Channel Enlargement

Plan 9 - Clear Lake Outlet Channel Enlargement and Bypass

Plan 10 - Clear Lake Outlet Channel Enlargement and Modified Bypass

(Plans 8, 9, and 10 provide net benefits and are, therefore, discussed in the "Alternatives Considered Further" subsection.)

LOWER BASIN (Cache Creek)

Plan 11 - No Action. - (The "no action" alternative is not considered viable because uncontrolled sediment deposition in the Yolo Bypass would continue. This alternative is, however, discussed further in the "Alternatives Considered Further" subsection in order to compare the effect of proposed plans to conditions expected to occur with no Federal participation.)

Plan 12 - Nonstructural Flood Control Alternatives. - Because the major portion of the flood plain in the lower basin is at present used for agriculture and is expected to continue to be so used, nonstructural measures would not aid in preventing flood damages and, therefore, were not considered further. The State of California Reclamation Board has recently considered adoption of a designated floodway in the reach from about Interstate 5 upstream to Rumsey. Public hearings have been held, and further consideration is being given to adoption of the floodway.

Plan 13 - Raise Settling Basin Levees

Plan 14 - Raise Settling Basin Levees with Wildlife Refuge

(Plans 13 and 14 were determined to be feasible and are, therefore, discussed in the "Alternatives Considered Further" subsection.)

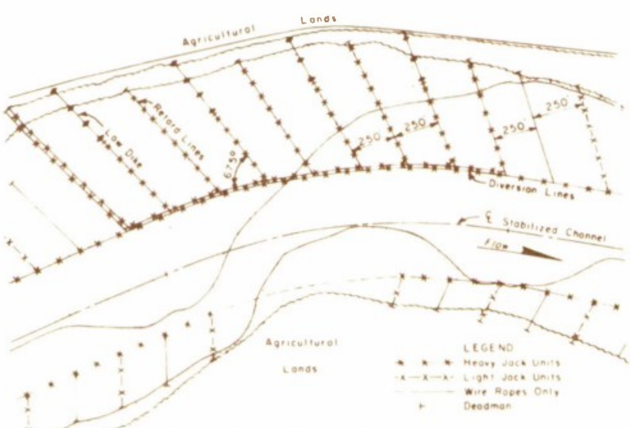
Plan 15 - Excavate Settling Basin. - With this plan, the existing 3,600-acre basin would be purchased and, for optimum use, converted to a national or State wildlife refuge. Sediment would be removed periodically from the existing basin, thereby reestablishing its storage capacity and allowing about 60 percent of the sediment currently discharging into the Yolo Bypass to be trapped in the basin. However, because only about one-tenth of the sediment is potentially marketable and because removing and hauling is much more expensive than constraining sediment to the existing basin, this alternative was not considered further. Plans 13 and 14 were considered more practical and economical solutions to the sediment problem. A photograph of the settling basin and adjacent facilities is shown on plate 3.

Plan 16 - New North Settling Basin. - Cache Creek flows would be diverted into a new settling basin north of the existing basin where productive agricultural lands are located.

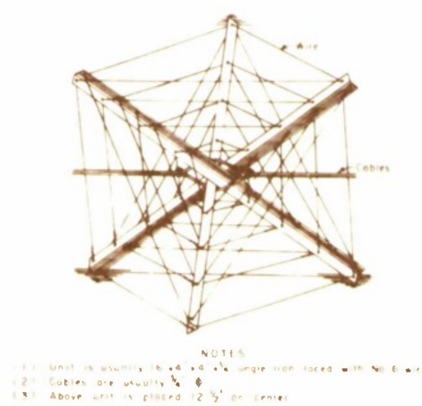
However, because of its limited storage capacity of 8,500 acre-feet (25-year storage), this plan would not provide a long-term solution; therefore, the plan was not considered further.

Plan 17 - New South Settling Basin. - Cache Creek flows would be diverted under Interstate 5 into a new settling basin south of the existing basin where less desirable agricultural lands are located; however, because the costs for relocating the railway along the southern boundary of the existing basin and constructing Interstate 5 highway structures over the channel would be very high in comparison to other more practical sediment control solutions, this alternative was not considered further.

Plan 18 - Kellner Jetty System. - This system, shown in the following sketch, consists of iron jacks tied together with steel cable and anchored to the streambank. The system would cost about $5.3 million to install. Sediment would deposit upstream within the system, thus decreasing the amount reaching the Yolo Bypass. However, this plan was not considered further because the jetty fields would be inefficient in trapping sediment and would require continued removal of sediment to assure a long-term life. The cost to move and place the required amount of material would be in excess of $17 million over the 50-year project life. Since only a 33 percent trap efficiency could be provided, additional downstream sediment control works would be necessary. Furthermore, wildlife agencies and environmental concerns strongly oppose such a jetty system.



TYPICAL KELLNER JETTY FIELD



STANDARD UNIT KELLNER JACK

Plan 19 - Brooks Sediment Reservoir. - With this alternative a sediment reservoir would be constructed upstream near the town of Brooks. This reservoir would function as a large detention basin which would cause deposition as water ponded and flow velocities decreased. However, the first cost of this sediment reservoir would be nearly $35 million, which is far in excess of potential sediment control benefits that would be provided; thus, this plan is not economically feasible. Also, nearly 3,000 acres of the scenic and highly productive Capay Valley would be inundated over the life of the project. For these environmental and economic reasons, this alternative was not considered further.

Alternatives Considered Further

As previously discussed, many of the plans were eliminated from further consideration because of limited economic feasibility, significant environmental problems, or limited potential for providing long-term solutions. The alternatives discussed below were selected for further consideration, and a summary of the economic, environmental, and social effects of each plan is presented in tables 1, 2, and 3. Note that each of these plans which call for Federal participation is economically feasible.

UPPER BASIN (Clear Lake)

No Action (Plan 1) - The Federal Government would take no action, either by structural or nonstructural measures, to reduce flood damages. However, as a participant in the National Flood Insurance Program, Lake County has enacted zoning ordinances to control and regulate land use and construction within the 100-year flood plain (land area inundated once per hundred years, on the average). Nevertheless, potential storms could again cause flooding and related damages, which in the future could be more costly even with restrictions imposed upon future development on the Clear Lake rim. In 1958 about 4,000 acres of residential, commercial, and agricultural lands were inundated, causing an estimated $878,000 in damages (1958 prices), and in January 1970 about 1,600 acres were flooded around the rim of the lake, with damages estimated at $485,000 (1970 prices). With "no action" existing streamflow and lake characteristics or patterns would not be modified, and riparian vegetation and wildlife habitat would be disturbed by natural processes or flooding and continued development on the lake rim. "No action" is considered unacceptable because the serious flood problem on the Clear Lake rim would not be alleviated. A photograph of the Clear Lake Outlet Channel and adjacent facilities is shown on plate 2.

Flood Proofing Future Facilities (Plan 5) - As discussed previously, Lake County as a participant in the National Flood Insurance Program is required to adopt ordinances or other controls to regulate land use and construction within the 100-year flood plain (land area inundated once per hundred years, on the average). With this alternative, future development would, additionally, be required to be flood proofed to the level of the Standard Project Flood, which is a flood representing the critical flood runoff volume and peak discharge that may be expected from the most severe combination of meteorologic and hydrologic conditions that are considered reasonably characteristic of the hydrologic region involved. For Clear Lake, the Standard Project Flood corresponds to a Clear Lake stage of about 13.01 feet (1,331.66 feet m.s.l.) on the Rumsey gage at Lakeport. Flood proofing would consist of elevating future buildings on pads or piles, constructing dikes, providing watertight closures and anchorage systems, waterproofing, or using any other such method designed to resist inundation. Because expenses would be borne by individual property owners, the increased costs of flood proofing may tend to discourage development in the Standard Project Flood plain; consequently, this plan would satisfy wildlife agencies and environmental interests concerned that the area is already

overdeveloped. However, this plan would not protect existing development from flooding, a problem which greatly concerns individuals and local government in the Clear Lake area. By letter dated 19 December 1975, the Lake County Flood Control and Water Conservation District objected to this plan by stating the District was already participating in the National Flood Insurance Program. The letter voiced the concern that the economic and individual costs of flood proofing new and replacement structures would be excessive. In addition, the District stated that the damages and interruption to normal course of business during the long periods when existing roads, sewerlines, and other facilities are inundated by high lake levels are too high a price to pay and would not be alleviated by nonstructural flood proofing methods. The letter concluded by expressing support for enlargement of the Clear Lake Outlet Channel as a means of providing flood control assistance to development on Clear Lake rim.

Clear Lake Outlet Channel Enlargement (Plan 8) - With this alternative, about 4.5 miles of the 5-mile-long Clear Lake Outlet Channel would be enlarged and/or widened, thus necessitating relocating two bridges, 18 residences, and numerous docks. In total, 130 ownerships would be affected. Enlargement of the channel would, of course, be subject to the restrictions of the Gopcevic and Bemmerly Decrees, which would have to be modified before the plan could be implemented. Also, in the future structures built on the rim of Clear Lake would be required to continue to build at or above the 11.85-foot elevation currently required by the National Flood Insurance Program since this requirement is economically justified. This requirement would insure that development continuing to flood proof to 11.85 feet would be protected from an extremely infrequent flood as opposed to the 100-year flood under current conditions. Furthermore, due to the increased costs of flood proofing, development would be discouraged from locating in the flood plain, thereby satisfying concerns of local government and environmental interests that the area is already overdeveloped. However, local interests have indicated that channel enlargement alone is unacceptable because of the relatively high cost of relocations when compared to other alternatives and the disruption of development along the outlet channel. As noted in table 3, this plan provides identical flood control benefits to plans 9 and 10; however, its first cost is about $2.1 million in excess of plan 9, with a significant portion for lands and relocations. The U.S. Fish and Wildlife Service and the California Department of Fish and Game indicate that this plan will be more damaging to fish and wildlife than plans 9 and 10.

Clear Lake Outlet Channel Enlargement and Bypass (Plan 9) - This alternative is similar to the preceding, but only 3.3 miles of the 5-mile channel would be enlarged, and a 1.1-mile-long channel would be constructed to bypass the highly developed portions of the Clear Lake Outlet Channel, thereby lessening the impact of the plan on streamside development. The bypass channel would have a weir at its upstream end and a control structure in the outlet channel adjacent to the weir to control flow into the bypass channel. These two structures would function to ensure that design flows would be conveyed down both the Clear Lake Outlet Channel and the bypass channel during flood periods. For instance, for a "system" flow of 8,000 cfs, 2,000 cfs would be carried by the existing channel and 6,000 cfs by the bypass channel.

Clear Lake Outlet Channel Enlargement and Modified Bypass (Plan 10) - Again, this plan is similar to the preceding two plans, except that the bypass channel would be about 2,500 feet longer and would follow a meandering alignment designed to enhance the fish and wildlife resources of the area while also providing the primary function of flood control. Additionally, the Anderson Marsh, an adjacent 560-acre ecosystem heavily utilized by fish and wildlife, would be purchased and preserved in its natural state to prevent further encroachment by manmade development. Preservation of the marsh would be consistent with Section 150 of Public Law 94-587 and a related Executive Order.

LOWER BASIN (Cache Creek)

No Action (Plan 11) - The Federal Government would, as a result of this investigation, take no action to control sediment or reduce erosion in lower Cache Creek Basin through structural or nonstructural measures. Uncontrolled erosion in and along Cache Creek and sediment flow from the creek can be expected to continue at its present rate. If no action is taken, Cache Creek sediment will continue to deposit in the Yolo Bypass, downstream navigation channels, and San Francisco Bay, thus threatening the integrity of the Sacramento River Flood Control Project. Extensive damages and loss of life could be expected if levees failed. To maintain freeboard standards on these portions of the Sacramento River Flood Control Project, levees in the Yolo Bypass, the Knights Landing Ridge Cut, and along the Sacramento River would have to be raised because of backwater effects caused by deposited sediment. These enlargements would not have to be undertaken if other, less expensive structural solutions were developed for sediment control. Sediment deposition has also impaired the functioning of 435 acres of industrial waste oxidation ponds owned by the city of Woodland. For these reasons, "no action" is considered unacceptable.

Raise Settling Basin Levees (Plan 13) - With this plan, sediment control would be achieved by enlarging the existing Cache Creek Settling Basin levees to provide an additional 15,500 acre-feet of storage capacity; rebuilding the Cobble Weir; and enlarging the Cache Creek project levees for 0.7 mile upstream of the basin to compensate for backwater effects. The basin would be purchased in fee and 2,950 acres of the 3,600-acre basin would be leased back to agricultural interests for production of crops currently being grown, thereby partially offsetting expenses incurred by project construction. By purchasing the basin, the State of California would be able to dispose of deposited sediment as necessary to prolong the life of the basin. These deposited sediments are excellent for topsoil and construction fill material, and about 50,000 cubic yards could be furnished annually to local topsoil distributors.

Raise Settling Basin Levees with Wildlife Refuge (Plan 14) - For sediment control, this plan is identical to Plan 13. The basin would be purchased, but rather than leasing the lands back to local farmers for agricultural use, the entire 3,600 acres would be established as a National Wildlife Refuge. The interior of the basin would be designed to accommodate the refuge, and operation and maintenance requirements would be established so that deposited sediment

could be excavated to prolong the life of the basin. The U.S. Fish and Wildlife Service, by letter dated 5 January 1976, stated that excavation of sediment from the settling basin on a rotational basis ". . . lends itself to the establishment of a wildlife refuge as a compatible part of the project." Addition of the refuge would improve waterfowl distribution, disease loss, and crop depredation. Recreational uses such as hunting, fishing, and environmental education would increase.

National Economic Development (NED) Plans

UPPER BASIN (Clear Lake)

The NED plan for the Upper Basin (Clear Lake) is similar to Plan 9, "Clear Lake Outlet Channel Enlargement and Bypass," except that neither a weir nor a control structure would be provided at the mouth of the bypass, since design flows could be conveyed without these structures. Also, no riparian vegetation would be planted along the bypass channel, further reducing costs. The NED objective is best satisfied by enlarging 3.3 miles of the existing outlet channel and, to minimize relocation costs, constructing a 1.1-mile-long bypass channel. Although all structural alternatives considered would increase the capacity of the Clear Lake Outlet Channel to 8,000 cfs and would provide identical benefits associated with reduction in flood damages on the lake rim, the NED plan would accomplish this at the least cost, thereby providing the greatest net benefits of all plans developed to alleviate flooding in upper Cache Creek Basin. Table 1, Summary of Economic-Environmental-Social Effects, shows the plan evaluations.

LOWER BASIN (Cache Creek)

Plan 14, "Raise Settling Basin Levees with Wildlife Refuge," is designated as the NED plan because it best meets the NED objective of providing greater net benefits than any other plan developed for sediment control in the lower Cache Creek Basin. This plan is described in Table 2.

Environmental Quality (EQ) Plans

UPPER BASIN (Clear Lake)

Plan 10, "Clear Lake Outlet Channel Enlargement and Modified Bypass" has been designated as the EQ Plan for the Upper Basin (Clear Lake). By enlarging a 3-mile-long portion of the existing outlet channel and constructing a meandering, 1.6-mile-long bypass channel, fishery resources would be enhanced and the quality of natural resources improved, in addition

to partially solving the flood problems on the Clear Lake rim. Also, the 560-acre Anderson Marsh would be purchased and preserved in its natural state to preclude further development or uses other than for fish and wildlife.

LOWER BASIN (Cache Creek)

To meet the environmental quality objectives to preserve ecological values, a plan similar to Plan 14, "Raise Settling Basin Levees with Wildlife Refuge," was selected as the EQ Plan for the lower basin (Cache Creek). As in Plan 14, the entire 3,600-acre basin would be purchased and a wildlife refuge established compatible with sediment control. However, the EQ Plan differs from Plan 14 in that to enhance wildlife, sediment would not be excavated to prolong the life of the basin.

Although the refuge could be established in only a portion of the basin and, to reduce annual operating costs, the remainder of the lands leased to farmers, studies have shown that extensive farming would disrupt wildlife and detract from the potential of the basin for wildlife enhancement. Nevertheless, "crop-sharing" would allow farming in specified areas with a portion of the crop left unharvested for wildlife. This practice is traditional in many wildlife refuges in the Sacramento Basin and has successfully enhanced other wildlife refuge operations.

Selecting the Plans

UPPER BASIN (Clear Lake)

Based on evaluation of alternatives, Plan 9, "Clear Lake Outlet Channel Enlargement and Bypass," without the two control structures at the head of the bypass channel, would best satisfy the concerns of local interests and best alleviate the flood problems in the upper basin and the Clear Lake rim and be acceptable from an environmental standpoint. The structural solutions considered the most viable to provide flood protection to existing development were those in which the capacity of the Clear Lake outlet facility would be increased by enlarging the outlet channel and constructing a bypass channel to the economically optimized capacity of 8,000 cfs at a Clear Lake stage of 7.56 feet on the Rumsey gage at Lakeport. Adding a bypass channel as a feature of the flood control improvement would significantly increase net benefits and decrease the total project cost, including the cost to non-Federal interests due to fewer relocations; furthermore, the bypass channel is strongly supported by Lake County and would preserve portions of the existing natural channel and create additional riparian habitat along its length.

Of the remaining structural solutions, Plan 8, "Clear Lake Outlet Channel Enlargement," although technically and economically feasible, is not favored by local interests because enlarging the channel would be expensive and construction would disrupt the developed portion of the outlet channel. Plan 10, "Clear Lake Outlet Channel Enlargement and Modified

Bypass," is not favored by local interests because the longer, 1.6-mile-long bypass channel would increase construction, operation, and maintenance costs.

The nonstructural alternative considered further (Plan 5, "Flood Proofing Future Facilities") is unacceptable to local interests because existing development would not be protected. A comparison of plans developed in detail is shown in Table 1, Summary of Economic-Environmental-Social Effects, Clear Lake Flood Control Alternative Plans.

LOWER BASIN (Cache Creek)

Plan 14, "Raise Settling Basin Levees with Wildlife Refuge," was identified in plan formulation studies as the best plan to limit flow of Cache Creek sediment into the Yolo Bypass. Also, a wildlife refuge established within the settling basin would assist in preserving wetlands and enhancing wildlife, and reduce crop depredation losses in surrounding areas.

Plan 13, "Raise Settling Basin Levees," was also considered further; however, although this plan was technically sound and economically feasible, it provided lesser benefits than did Plan 14 and did not enhance wildlife. Selection of Plan 14 over Plan 13 is consistent with economic, environmental, and socioeconomic criteria listed in Section D of Appendix 1.

A comparison of plans developed in detail is shown in Table 2, Summary of Economic-Environmental-Social Effects, Sediment Control Alternative Plans.

The Selected Plans

This section contains descriptions of the selected plans which were formulated and identified in the preceding section. Also included are general descriptions of plan components and significant design, construction, and operation and maintenance aspects as well as accomplishments of the plans. Environmental, cultural, social, and economic effects of the selected plans are discussed in detail in the Environmental Statement, appendix 4.

Upper Basin (Clear Lake)

PLAN DESCRIPTION

As shown on plate 2, the plan selected to best meet flood control requirements of the Upper Basin (Clear Lake) consists of the following:

- Widening and/or deepening 3.3 miles of the existing 5-mile-long Clear Lake Outlet Channel to a capacity of 8,000 cubic feet per second (cfs) at a Clear Lake stage of 7.56 feet on the Rumsey gage at Lakeport.

- Constructing a 1.1-mile-long bypass channel around the highly developed area adjacent to the existing channel.

- Requiring future development to flood proof or otherwise construct above the elevation of the preproject 100-year flood plain.

- Releases from Clear Lake would be controlled by a modified operation of Clear Lake Dam, which is currently operated for water supply and flood control by Yolo County.

An artist's concept of the bypass channel is shown on page 47.

PLAN ACCOMPLISHMENTS

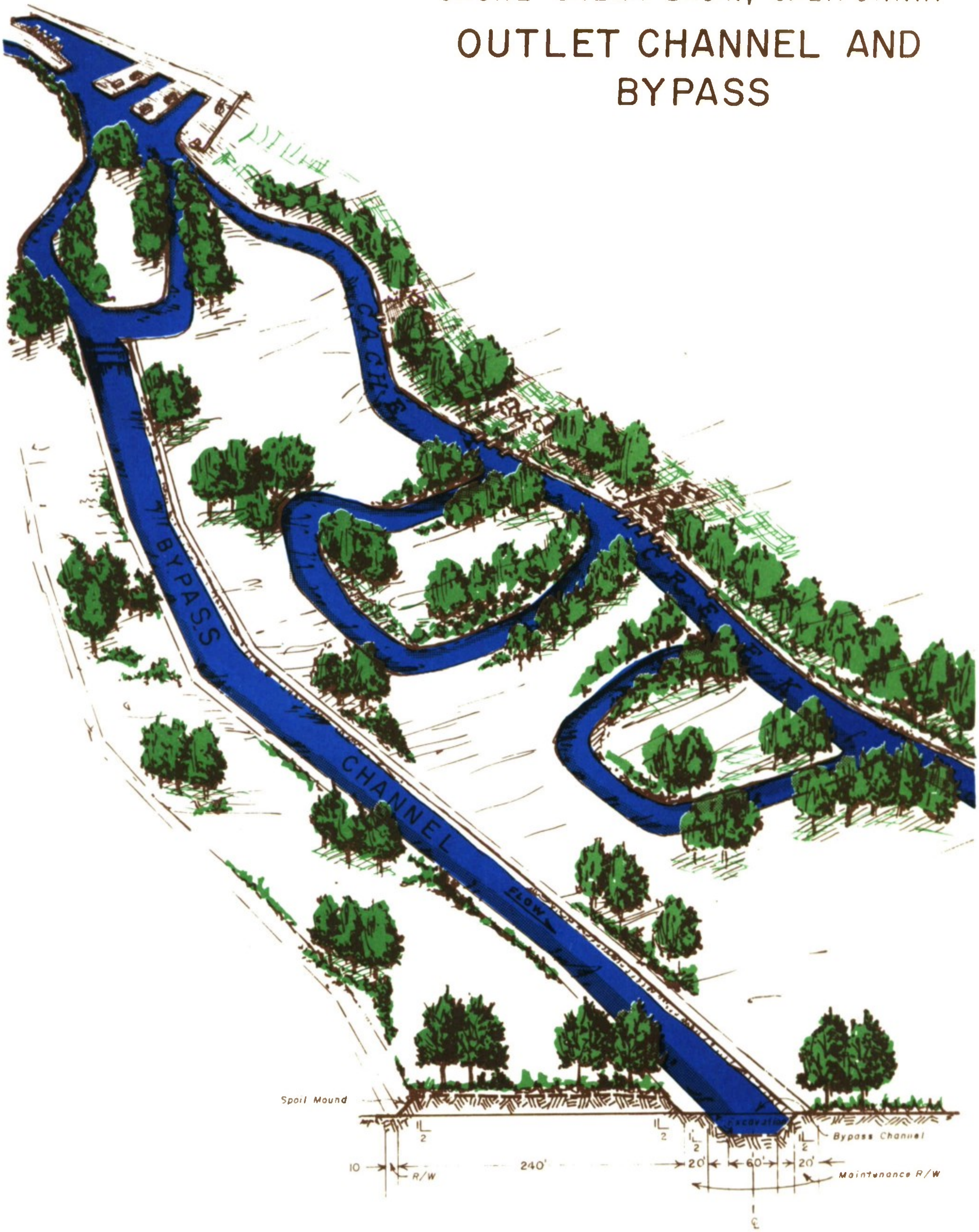
Major accomplishment of the plan would be reduction in flood damages to both existing and future development on the Clear Lake rim. Also, existing and potential urban areas and approximately 4,100 acres of existing and future agricultural areas would be protected from floods. It would reduce the level of the 100-year flood stage on Clear Lake by 2.25 feet, with an average annual decrease in flood damages of $1,170,200.

EFFECTS OF THE PLAN ON THE ENVIRONMENT

Primarily, the proposed plan would provide flood protection to homes, commercial developments, and agricultural crops encircling the Clear Lake rim, thus enhancing not only the quality of the human environment but the local economy as well. Although vegetation would be disturbed by enlargement of the existing channel, additional riparian vegetation would be planted, and new riparian vegetation would be created along the banks of the 1.1-mile-long bypass channel. The U.S. Fish and Wildlife Service by letter dated 26 July 1977 stated that it did not foresee the need to recommend any land acquisition for mitigative purposes. It further stated that this position had been coordinated with the California Department of Fish and Game. Results of Fish and Wildlife Service studies also showed that the more rapid drawdown of Clear Lake during flood periods would have no effect on Anderson Marsh because the project

CACHE CREEK BASIN, CALIFORNIA

OUTLET CHANNEL AND BYPASS



only increases releases when Clear Lake is above a stage of 7.56 feet, which is several feet above the elevation at which water enters the marsh. A cultural resources reconnaissance report was completed in accordance with Corps of Engineers regulation, "Identification and Administration of Cultural Resources" (33 CFR 305). By letter dated 4 November 1977, the State Historic Preservation Officer stated he was impressed with the "professional quality" of the reconnaissance report. The environmental statement, which includes details of environmental, cultural, social, and economic effects of the selected plan for the Upper Basin (Clear Lake), is attached to this report as appendix 4. A summary of these effects is shown on Table 1, Summary of Economic-Environmental-Social Effects, Clear Lake Flood Control Alternative Plans.

DESIGN

Basis of Design. - Channel construction and associated works for the upper Cache Creek Basin are based on the results of hydraulic computations. The proposed bottom width and invert gradient of the outlet channel represent a balance among such factors as a nondamaging water surface in Clear Lake, real estate requirements, Clear Lake Dam outflow, and pleasure craft requirements for local inhabitants near the outlet channel. The side slope of the channels would be 1 vertical on 2 horizontal in earth excavation and 1 vertical on 0.5 horizontal in rock excavation.

The upstream end of the bypass channel will have riprap on the side slopes and invert for a short distance. The location of the riprap is shown on plate 2. Hydraulic computations indicate that when the flow in the existing channel just upstream of the bypass channel is 8,000 cfs (design flow) approximately 6,000 cfs would be diverted into the bypass channel. The remaining 2,000 cfs would continue to flow down the existing channel. For flows exceeding 8,000 cfs, the existing channel (parallel to the bypass channel) would carry less than under preproject conditions. At lower flows (flows of about 500 cfs), approximately two-thirds of the flow would be conveyed by the bypass channel and about one-third by the existing channel.

A 36-inch diameter concrete conduit (inverted siphon) would be constructed at the intersection of Seigler Creek and the bypass channel to insure flow in the creek between the bypass channel and Cache Creek. Flows exceeding the capacity of the conduit during flood periods would be spilled into the bypass channel.

FOUNDATIONS AND MATERIALS

Borings taken by the State of California at the time of construction of the State Highway bridge over Clear Lake Outlet Channel and visual inspection provided the basis for modes of channel excavation. Because rock formations of hard dacite and andesite occur in various locations, the design side slopes for the excavated channel were steepened to 1 vertical on 0.5 horizontal, but earth excavation was left at 1 vertical to 2 horizontal design side slopes. Test borings and rock locations are shown on plate 2.

RIGHTS-OF-WAY

Rights-of-way and easements would be provided by local interests and would be required for all new and enlarged channels. The total channel rights-of-way, 79 acres, would be acquired in fee title. Easements for temporary spoil areas would total 80 acres.

RELOCATIONS AND MODIFICATIONS

Two bridges would have to be constructed over the bypass channel at State Highway 53 and old Highway 53. Numerous utilities, such as telephone, water, sewer, and powerlines, and several docks and residences would require relocation. These relocations and bridges are the responsibility of local interests and would have to be accomplished before construction or concurrently with the channel improvement.

CONSTRUCTION

Following completion and approval of advance engineering and design studies, and assuming adequate funding, the Upper Basin portion of the project could be completed in about 1½ years and would cost $6,050,000 to construct. Borrow material from excavation of existing and bypass channels would be spread over 80 acres adjacent to the channel. These areas would not be damaged and would be leased during the 5-year settlement period. The Clear Lake Dam meets current dam safety requirements and can be effectively operated under project conditions. Prior to construction, a more detailed inspection of the dam will be made to determine if minor modifications will be necessary.

OPERATION AND MAINTENANCE

Annual operation and maintenance and replacement costs associated with the channel improvement project would be a non-Federal responsibility and would average $11,400 for the enlarged channels, rock revetment, and siphon over the 100-year project life. Most channel maintenance operations would be performed with watercraft, except for the bypass channel, and would be relatively expensive due to the large number of private docks. The Yolo County Flood Control and Water Conservation District currently operates the Clear Lake Dam for water supply and flood control in accordance with provisions of the Gopcevic Decree. The operation would be modified in accordance with regulations prescribed by the Secretary of the Army.

Lower Basin (Cache Creek)

PLAN DESCRIPTION

As shown on plate 3, the plan selected to best achieve the desired degree of sediment control on Cache Creek, thus preserving the integrity of the Sacramento River Flood Control Project, consists of the following:

- Enlarging the existing perimeter levees of the Cache Creek Settling Basin an average of 12 feet to provide 50 years of sediment storage capacity and enlarging the existing project levees from the settling basin mouth upstream to County Road 102.

- Reconstructing and enlarging the existing Cobble Weir.

- Degrading the existing training levees and rebuilding them adjacent to the western perimeter levee to allow utilization of the entire basin for sediment deposition.

- Purchasing in fee 3,600 acres of the existing settling basin and establishing a wildlife refuge.

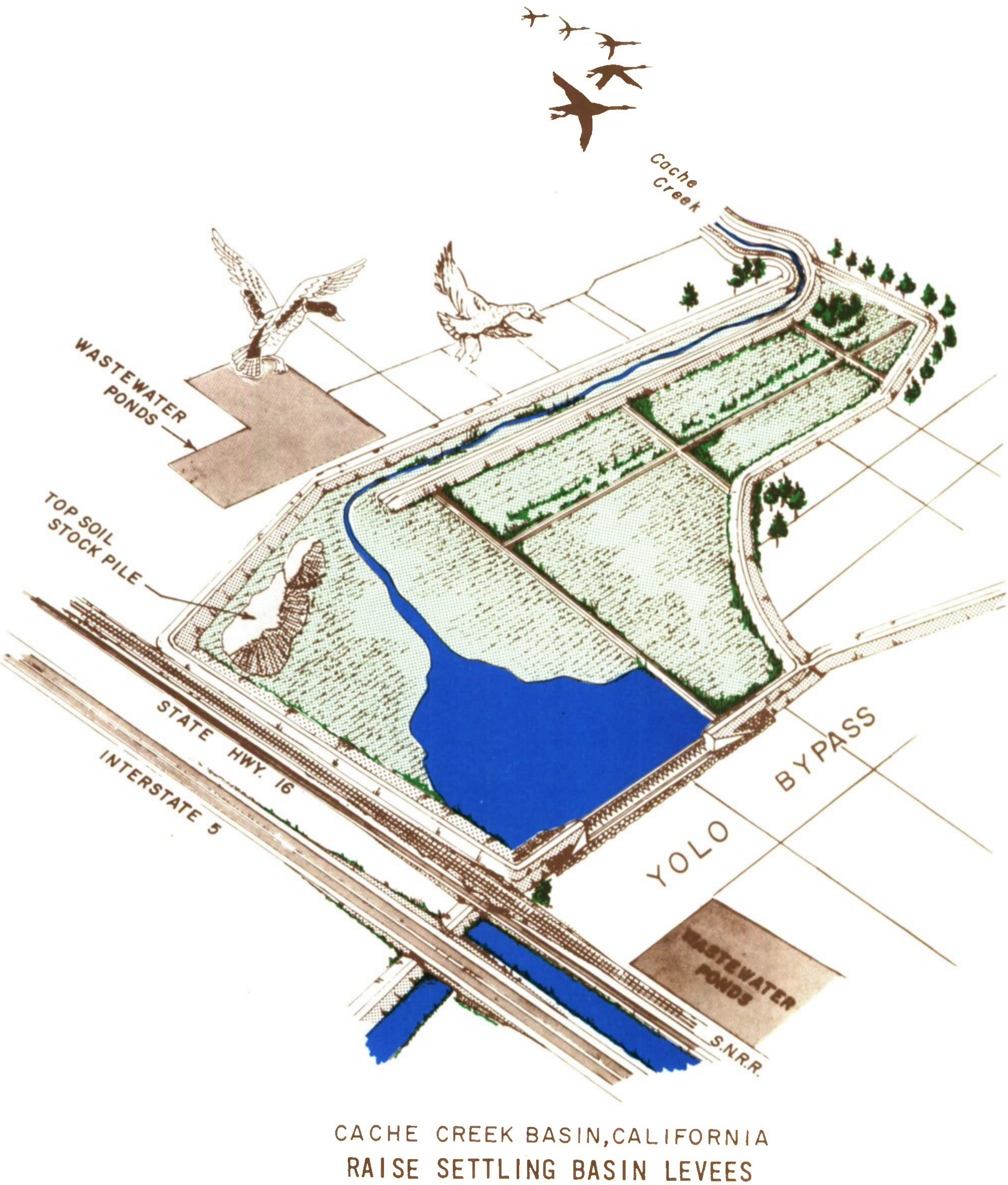
- Excavating 50,000 cubic yards of sediment annually for use by local topsoil distributors.

An artist's concept of the settling basin and wildlife refuge is shown on page 51.

PLAN ACCOMPLISHMENTS

A major accomplishment of the plan would be the trapping on the average of 340 acre-feet per year of Cache Creek's sediment load upstream of the Yolo Bypass over 50 years. With this control, the integrity of the Sacramento River Flood Control Project would be insured, and about 435 acres of sewage oxidation ponds owned by the city of Woodland would be protected. Also, downstream dredging requirements would be reduced at an average annual savings of $268,000.

Another accomplishment of this plan would be the creation of a National Wildlife Refuge operated by the U.S. Fish and Wildlife Service within the settling basin. Such a refuge would help meet objectives of the U.S. Fish and Wildlife Service and the California Department of Fish and Game for wetland preservation in the Central Valley of California and for additional refuge for migratory birds. In addition, recreational consumptive uses, such as hunting and fishing, and nonconsumptive uses, such as environmental education, would increase. Average annual wildlife enhancement benefits would total $502,000. With this plan, settling basin lands would be purchased in fee, thereby allowing sediment to be excavated and used in the future for structural embankment, agricultural soil improvement, and other related uses.



CACHE CREEK BASIN, CALIFORNIA
RAISE SETTLING BASIN LEVEES
WITH WILDLIFE REFUGE

EFFECTS OF THE PLAN ON THE ENVIRONMENT

Control of Cache Creek sediment would decrease the threat of failure of the Sacramento River Flood Control Project. Creation of a National Wildlife Refuge, although temporarily disrupting existing vegetation and wildlife during construction, would provide habitat for a greatly increased and diversified wildlife population. The U.S. Fish and Wildlife Service, by letter dated 26 July 1977, stated that it did not foresee the need to recommend any land acquisition for mitigative purposes. It further stated that this position had been coordinated with the California Department of Fish and Game. The environmental statement, which includes details of environmental, cultural, social, and economic effects of the selected plan for the Lower Basin (Cache Creek), is attached to this report as appendix 4. A summary of these effects is shown on Table 2, Summary of Economic-Environmental-Social Effects, Sediment Control Alternative Plans.

DESIGN

The proposed plan would provide 15,500 acre-feet of sediment storage capacity, based on a 50-year project life and a 50 percent sediment trap efficiency. A concrete weir would be designed to provide 50 percent sediment trap efficiency throughout the life of the project and to pass a flow of up to 30,000 cfs.

Existing settling basin levees would be raised an average of 12 feet for a total average height of 20 feet, and would provide 5 feet of freeboard above the water surface profile for a Cache Creek flow of 30,000 cfs. The interior training channel levee would have crown elevations 2 feet less than the corresponding opposite west basin levee. Existing training channel levees would be degraded, and the training channel would be relocated adjacent to the west basin levee.

All project levees would be provided with a 12-foot crown width and side slopes of 1 on 3 on the waterside and 1 on 2 on the landside. The west basin levee would be provided with a standard levee inspection trench. All project levees would have a stabilized aggregate surfaced patrol road on the levee crown. The location of the proposed project levees is shown on plate 3.

A new channel between the new training levees would be excavated to negate backwater effects in Cache Creek above Road 102 due to insufficient channel capacity. The training channel would be maintained throughout the life of the project to retain the initial channel capacity. In addition, a low flow pilot channel would be maintained from the training channel, across the basin, and through outlets in the weir.

RELOCATIONS AND MODIFICATIONS

Because the project flood plane elevation in the settling basin would be increased during the final stage of project life, the city of Woodland's storm runoff pumping facility pumping head would have to be increased by about 12 feet, or about 2½ times the existing pumping head.

Relocations would consist of removing three dwellings located in the north portion of the settling basin and providing the residents with relocation assistance.

RIGHTS-OF-WAY

The State of California holds rights-of-way for settling basin lands, but the project plan would require rights-of-way in fee for the entire settling basin, approximately 3,600 acres. The entire 3,600 acres would be purchased in fee by the Federal Government, which would then be reimbursed by non-Federal interests for the portion attributed to sediment control. This amount, $1.8 million, is the cost which would have been required to acquire flowage, sediment deposition, and removal easements over the 50-year project life should these lands not have been purchased in fee. Levee enlargement for Cache Creek from the settling basin to Road 102 would be on the waterside of the existing levee, and no additional rights-of-way would be required beyond those presently held by the State of California.

CONSTRUCTION

Following completion and approval of advance engineering and design studies, and assuming adequate funding availability, it is estimated that the Lower Basin portion of the project could be constructed in 2 years.

All facilities, except those needed for refuge operation, would be constructed during one construction season. Future facilities within the refuge may be constructed by the U.S. Fish and Wildlife Service as plans are developed. All scarred areas would be planted with native vegetation after construction.

OPERATION AND MAINTENANCE

Operation and maintenance of sediment control facilities would be a non-Federal responsibility and would be accomplished in accordance with Federal regulations. Normal operation and maintenance costs would be expected for the enlarged weir and levees, but a significant operation expense will be incurred by the U.S. Fish and Wildlife Service to pump the water needed for the wildlife refuge operation. As under existing conditions, the eastern training levee would be modified as appropriate during the life of the project to direct flow and thus sediment deposition across the sedimentation basin.

Coordination would be required between the agency operating the wildlife refuge and the California Reclamation Board to insure compatibility between sediment control and wildlife enhancement. Annual costs for operation and maintenance average $19,100 for sediment control operations and $125,000 for the wildlife refuge.

Economics of the Selected Plans

Methodology

Economic justification of the proposed works was established by comparing the equivalent average annual costs with the estimated equivalent average annual benefits which would be realized over the 100-year and 50-year periods of analysis for flood control (Upper Basin) and sediment control (Lower Basin), respectively. Comparison of annual costs and benefits, referred to as the benefit-cost ratio, was developed as a means of demonstrating the project feasibility by showing the relative average annual benefits to the annual costs. The value of benefits and costs at their time of accrual is made comparable by conversion to an equivalent time basis using an appropriate interest rate. An interest rate of 6⅝ percent was used in this report. The net effect of converting benefits and costs in this manner is to develop average annual equivalent values.

Costs

UPPER BASIN (CLEAR LAKE)

Cost estimates for the project include a 25 percent contingency factor and costs for engineering and design and supervision and administration based on costs experienced for similar projects throughout the nation, amounting to 20 percent. The period of analysis for the plan was selected as 100 years. Interest and amortization charges are based on an interest rate of 6⅝ percent. Annual charges also include operation, maintenance, and replacement costs. Interest during construction was not charged to the plan because of its short construction period, estimated at 1½ years. The estimated first and annual costs of the project, based on October 1977 price levels, are summarized on page 55, and detailed estimates can be found in Section F of Appendix 1.

SUMMARY OF FIRST COSTS

Channels	$3,100,000
Lands and Damages	1,800,000
Relocations	406,000
Engineering and Design	440,000
Supervision and Administration	304,000
Total Project First Cost (Upper Basin)	$6,050,000

SUMMARY OF ANNUAL COSTS

Interest	$400,800
Amortization	800
Operation and Maintenance	11,400
Total Project Annual Cost (Upper Basin)	$413,000

LOWER BASIN (CACHE CREEK)

Cost estimates for the project include a 25 percent contingency factor and costs for engineering and design and supervision and administration based on costs experienced for similar projects throughout the nation, amounting to 20 percent. The period of analysis for the plan was selected as 50 years. Interest and amortization charges are based on an interest rate of 6⅝ percent. Annual charges also include operation and maintenance costs. Interest during construction was not charged to the plan because of its short construction period, estimated at 2 years. The estimated first and annual costs of the project, based on October 1977 price levels, are summarized below, and detailed estimates can be found in Section F of Appendix 1.

SUMMARY OF FIRST COSTS

Lands and Damages	$2,650,000
Refuge Facilities	560,000
Levees	3,450,000
Weir	3,400,000
Relocations	390,000
Engineering and Design	870,000
Supervision and Administration	590,000
Total Project First Cost (Lower Basin)	$11,910,000

SUMMARY OF ANNUAL COSTS

Interest	$789,000
Amortization	33,000
Operation and Maintenance	144,000
Total Project Annual Costs (Lower Basin)	$966,000

Benefits

UPPER BASIN (CLEAR LAKE)

The primary benefits that would accrue to the plan would be flood damage reduction and National Economic Development (NED) employment benefits. The plan would also provide intangible benefits such as a reduced threat to human life and improved public health and morale of the local populace. Estimated monetary benefits are based upon October 1977 price levels, 1985 economic conditions, and a 100-year period of analysis.

Future average annual flood damages prevented (benefits) represent the difference in average annual flood damages that would be expected without the project and residual average annual damages that would remain with the project. These flood damage reduction benefits are estimated at $1,170,200 annually.

NED employment benefits attributable to a project are equal to wages paid to local workers during construction who, in the absence of the project, would most likely be unemployed. Average annual NED employment benefits would total $35,700.

Total average annual benefits associated with this portion of the project would be $1,205,900.

LOWER BASIN (CACHE CREEK)

The primary benefits that would accrue to the plan would be prevention of flood damages expected to occur without the project, reduced sediment dredging requirements in the Yolo Bypass downstream and navigation channels of the Sacramento River and San Francisco Bay system, wildlife enhancement benefits associated with establishment of the wildlife refuge, and NED employment benefits. Estimated monetary benefits are based upon October 1977 price levels, 1985 economic conditions, and a 50-year period of analysis.

Future flood damages prevented (benefits) by construction of the project are based upon costs required to maintain the integrity of the Sacramento River Flood Control Project. If sediment were allowed to continue to deposit in the Yolo Bypass, damage to development in the bypass would occur, and in addition, a backwater effect would be created which would cause infringement of the design flow on freeboard of the Yolo Bypass, Knights Landing Ridge Cut, and a portion of the Sacramento River. It would be necessary, in that case, to strengthen these levees and restore freeboard requirements. The average annual flood control benefit from this "least costly alternative" analysis totals $1,114,300.

Sediment control benefits associated with this plan are based upon reduced dredging of about 95 acre-feet of sediment annually from the Yolo Bypass, Sacramento River, navigation

channels, and San Francisco Bay. Reduced dredging expenditures (benefits) would average $268,000 annually. Without sediment control measures, about 111 acre-feet of sediment would annually deposit in the aforementioned areas and would require dredging.

Wildlife enhancement benefits associated with this plan are based upon reduced waterfowl losses due to disease, contribution to the National Waterfowl Management Program, reduced crop depredation, and hunting and visitation on the proposed refuge. Average annual benefits would total $502,000 annually as indicated by the U.S. Fish and Wildlife Service.

NED employment benefits attributable to a project are equal to wages paid to local workers during construction who, in the absence of the project, would most likely be unemployed. Average annual NED employment benefits would total $81,700.

Total average annual benefits associated with this portion of the project would be $1,966,000. It should be noted that a potential project benefit exists for revenue that could be obtained by the sale of 50,000 cubic yards of sediment annually to topsoil distributors. However, such a benefit has not been claimed since it is assumed that any benefit would be offset by costs of removal.

Justification

Comparison of the average annual benefits with the average annual costs is tabulated below. Although intangible benefits and tangible secondary benefits may accrue to the national economy, only tangible primary benefits are included in the tabulation.

AVERAGE ANNUAL COSTS AND BENEFITS
UPPER BASIN (Clear Lake)

Annual Costs	$ 413,000
Annual Benefits	1,205,900
Benefit-Cost Ratio	2.9 to 1

AVERAGE ANNUAL COSTS AND BENEFITS
LOWER BASIN (Cache Creek)

Annual Costs	$ 966,000
Annual Benefits	1,966,000
Benefit-Cost Ratio	2.0 to 1

Division of Plan Responsibilities

Pertinent information regarding cost apportionment between Federal and non-Federal interests is presented in the paragraphs below. The cost apportionment is based on traditional cost-sharing policy.

Cost Apportionment

UPPER BASIN (Clear Lake)

The tabulation "Cost Apportionment - Upper Basin" shows the apportionment of the first and annual costs between Federal and non-Federal interests. Federal and non-Federal responsibilities are described below.

FEDERAL RESPONSIBILITIES

Sharing of costs between Federal and non-Federal interests for the flood control project is based upon the standard requirements established as Federal policy for "local protection" works. Under this policy, the Federal Government would be responsible for all construction costs. In addition, the Federal Government would design and prepare detailed plans and construct the project.

NON-FEDERAL RESPONSIBILITIES

Under the Federal policy requirements for "local protection" works, non-Federal interests would be required to furnish the following:

- Provide all lands, easements, and rights-of-way for construction and maintenance of the project, including all relocations and alterations of buildings, roads, highways, bridges, sewers, and utilities.

- Maintain and operate project facilities after completion of the project in accordance with regulations prescribed by the Secretary of the Army and perform anticipated replacements.

- Hold and save the United States free from damages due to the construction and operation of the project, except for damages due to the fault or negligence of the United States or its contractors.

- Adjust all claims regarding water rights that might be affected by the flood control improvements.

- Require future development on Clear Lake rim. to build above or otherwise flood proof to the elevation specified under the National Flood Insurance Program. The specified elevation will be that in effect just prior to construction of the project.

LOWER BASIN (Cache Creek)

The tabulation "Cost Apportionment - Lower Basin" shows the apportionment of the first and annual costs between Federal and non-Federal interests. Responsibilities of Federal and non-Federal interests are described below.

FEDERAL RESPONSIBILITIES

Sharing of costs between Federal and non-Federal interests for the sediment control project is based on the requirements established as Federal policy for "local protection" works. Under this policy, the Federal Government would purchase in fee the entire 3,600-acre settling basin and would be reimbursed by local interests for those lands attributed to sediment control. The Federal Government would also be responsible for all sediment control construction costs, design, preparation of detailed plans, and construction of the project.

Responsibility for construction, operation, and maintenance associated with the wildlife refuge would be similar to the requirements of Public Law 89-72, as amended. All of the costs for lands, facilities, and construction, as well as all refuge operation and maintenance costs, will be a responsibility of the Federal Government.

NON-FEDERAL RESPONSIBILITIES

Under the Federal policy requirements for "local protection" works, non-Federal interests would be required to furnish the following:

- Provide all easements and rights-of-way for construction and maintenance of the sediment control project, including all relocations and alterations of buildings, roads, highways, sewers, and utilities, and reimburse the Federal Government for those lands attributed to sediment control.

• Maintain and operate sediment control facilities after completion of the project in accordance with requirements of the Secretary of the Army in a manner compatible with wildlife enhancement.

• Hold and save the United States free from damages due to the construction and operation of the sediment control project, except for damages due to the fault or negligence of the United States or its contractors.

• Adjust all claims regarding water rights that might be affected by the sediment control improvements.

• Over the 50-year project life, remove a quantity of sediment from the Cache Creek Settling Basin equivalent to at least 50,000 cubic yards per year.

COST APPORTIONMENT - UPPER BASIN

	FEDERAL Flood Control ($)	NON-FEDERAL Flood Control ($)
FIRST COSTS	3,740,000	2,310,000
ANNUAL COSTS		
Interest and Amortization	248,300	153,300
OM&R	0	11,400
TOTAL	248,300	164,700

COST APPORTIONMENT - LOWER BASIN

	FEDERAL		NON-FEDERAL	
	Flood Control	Wildlife Enhancement	Flood Control	Wildlife Enhancement
FIRST COSTS	10,020,000	1,410,000	480,000	0
Adjustments for excess Federal flood control costs	-1,800,000*		+1,800,000*	
Adjusted Subtotals	8,220,000	1,410,000	2,280,000	0
Adjusted Totals	9,630,000		2,280,000	
ANNUAL COSTS				
Interest and Amortization	665,000		157,400	
OM&R	125,000		19,100	
TOTAL (Combined)	790,000		176,500	

*Represents that portion of the total cost of fee purchase of the 3,600-acre settling basin which is attributed to sediment control.

Proposed Revised Cost-Sharing Responsibilities

Pertinent information regarding possible cost apportionment between Federal and non-Federal interests based on future adoption and implementation of the President's recent water policy message is contained in the following paragraphs.

The President's Proposed Policy

The President's recent message proposing revised sharing of costs of Federal water projects is to involve states more heavily in water project decisions and to eliminate many of the conflicting rules governing cost-sharing for flood control projects.

Cost Apportionment

The tabulations "Cost Apportionment — Upper Basin" and "Cost Apportionment — Lower Basin" on the following pages show the apportionment of the first and annual costs for the respective areas. Federal and non-Federal responsibilities based on possible future implementation of the President's water policy are described below.

FEDERAL RESPONSIBILITIES

Sharing of costs between Federal and non-Federal interests is based upon standard requirements established as Federal policy for "local protection" works, except as noted under "Non-Federal Responsibilities." Should the cost of lands, easements, rights-of-way, and relocations exceed 20 percent of the cost of flood damage reduction measures, application of the President's proposed policy would require the Federal Government to reimburse local interests for all costs in excess of 20 percent. The Federal Government would also design, prepare detailed plans for, and construct the project.

Responsibility for construction, operation, and maintenance associated with the wildlife refuge would be similar to the requirements of Public Law 89-72, as amended. All of the costs for lands, facilities, and construction, as well as all refuge operation and maintenance costs, would be a responsibility of the Federal Government.

NON-FEDERAL RESPONSIBILITIES

Non-Federal interests would be required to:

- Contribute a 5 percent cash share of the total first cost of the project, to be paid concurrently and proportionately with the Federal contractural obligation for project construction.

- Provide all lands, easements, and rights-of-way necessary for construction and maintenance of the project, including all relocations and alterations of buildings, roads, highways, bridges, sewers, and utilities.

- Pay or contribute in-kind that portion of the cost of flood damage reduction measures which, when added to the cost of lands, easements, rights-of-way, and relocations, would amount to 20 percent of the cost of flood damage reduction measures. Should the cost of lands, easements, rights-of-way, and relocations exceed 20 percent of the cost of flood damage reduction measures, the Federal Government would reimburse local interests for all costs in excess of 20 percent.

- Maintain, operate, and replace project facilities after completion of the project in accordance with regulations prescribed by the Secretary of the Army, except for the wildlife refuge, and conduct sediment control operations in a manner compatible with wildlife enhancement.

- Hold and save the United States free from damages due to the construction and operation of the project, except for damages due to the fault or negligence of the United States or its contractors.

- Adjust all claims regarding water rights that might be affected by the project.

- Require future development on Clear Lake rim to build above or otherwise flood proof to the elevation specified under the National Flood Insurance Program. The specified elevation will be that in effect just prior to construction of the project.

- Over the 50-year project life of the Cache Creek Settling Basin, remove a quantity of sediment equivalent to at least 50,000 cubic yards per year.

COST APPORTIONMENT - UPPER BASIN

	FEDERAL Flood Control ($)	NON-FEDERAL Flood Control ($)
FIRST COSTS (Traditional Cost-sharing)	3,740,000	2,310,000
Adjustment for Federal reimbursement for costs in excess of 20 percent of flood damage reduction measures	+1,100,000	-1,100,000
Adjusted subtotals	4,840,000	1,210,000
Adjustment for 5 percent non-Federal share of total first cost	-302,000	+302,000
Adjusted totals	4,538,000	1,512,000
ANNUAL COSTS		
Interest and Amortization	301,300	100,300
OM&R	0	11,400
TOTAL	301,300	111,700

Rev. 15 Aug 79

COST APPORTIONMENT - LOWER BASIN

	FEDERAL		NON-FEDERAL	
	Flood Control	Wildlife Enhancement	Flood Control	Wildlife Enhancement
FIRST COSTS (Traditional Cost-sharing)	10,020,000	1,410,000	480,000	0
Adjustment for excess Federal flood control costs	-1,800,000	-	+1,800,000	-
Adjusted subtotals	8,220,000	1,410,000	2,280,000	0
Adjustment for Federal reimbursement for costs in excess of 20 percent of flood damage reduction measures	+180,000	-	-180,000	-
Adjusted subtotals	8,400,000	1,410,000	2,100,000	0
Adjustment for 5 percent non-Federal share of total first cost	-525,000	-70,000	+525,000	+70,000
Adjusted totals	7,875,000	1,340,000	2,625,000	70,000
Adjusted totals	9,215,000		2,695,000	
ANNUAL COSTS				
Interest and Amortization	636,300		186,100	
OM&R	125,000		19,100	
TOTAL	761,300		205,200	

SUMMARY

The following tabulation illustrates the comparative cost-sharing that would be applicable for both traditional and for the President's proposed revised policy:

	TRADITIONAL POLICY	REVISED POLICY
FEDERAL FIRST COSTS		
Upper Basin	$ 3,740,000	$ 4,538,000
Lower Basin	9,630,000	9,215,000
TOTALS	$13,370,000	$13,753,000
NON-FEDERAL FIRST COSTS		
Upper Basin	$ 2,310,000	$ 1,512,000
Lower Basin	2,280,000	2,695,000
TOTALS	$ 4,590,000	$ 4,207,000

Plan Implementation

The steps necessary to follow in realizing the construction of the proposed plans of improvement are summarized as follows:

- This report would be reviewed by higher Corps of Engineers authorities including the South Pacific Division, the Board of Engineers for Rivers and Harbors, and the Office of the Chief of Engineers.

- The Chief of Engineers would then seek formal review and comment by the Governor of California and interested Federal agencies.

- Following the above State and interagency review, the final report of the Chief of Engineers would be forwarded by the Secretary of the Army to the Congress, subsequent to his seeking the comments of the Office of Management and Budget regarding the relationship of the project to the program of the President.

- Congressional authorization of the project would then be required.

- If the project is authorized, the Chief of Engineers would then include funds, when appropriate, in his budget requests for advance engineering and design of the project.

- On receipt of funds, advance engineering and design studies would be initiated, project formulation reviewed, and the plan reaffirmed or reformulated to meet the then current conditions.

- On approval of these studies, and when the Congress appropriates the necessary initial construction funds, formal assurances of local cooperation would be requested from non-Federal interests.

- Surveys, materials investigations, and preparation of design criteria, plans, specifications, and an engineering estimate of costs would then be accomplished by the District Engineer. At this time, the necessary local actions would be required. Bids for construction of the project would be invited and a contract awarded.

Following completion of the project, local interests would be responsible for operation and maintenance of flood control facilities in Lake County and sediment control facilities in Yolo County. The U.S. Fish and Wildlife Service would be responsible for operation and maintenance of the wildlife refuge in Yolo County.

It is not possible to accurately estimate a schedule for the above steps because of the variables in the reviewing, advance planning, and funding processes. Once the project is authorized and initially funded, it would be possible to complete design and construction within a 5-year period if adequate funds are available. An environmental impact statement is included as Appendix 4 of this feasibility report.

Views of Non-Federal Interests

Letters received from non-Federal interests expressing views and recommendations concerning the draft feasibility report and EIS are contained in Appendix 2 and summarized below.

- State of California

By letter dated 25 May 1978, the Resources Agency of the State of California indicated its support of the plan of improvement presented in the draft report. The Resources Agency found the project economically justified and eligible for State participation in the non-Federal capital costs. The letter also provided numerous other specific comments and suggestions which were incorporated into the final feasibility report and EIS.

- Yolo County Resource Conservation District

By letter dated 23 March 1978, the Yolo County Resource Conservation District stated that the project does not retain the sediment at its source or stabilize streambank erosion but instead addresses containment within the settling basin, and is thus in conflict with Section 208 of Public Law 92-500 (Clean Water Act of 1977). This report and Section D of Appendix 1 discuss why sediment control at the settling basin is the only economically feasible method of sediment control; thus, the sediment control plan is the only one in which participation by the Federal Government is justified.

- City of Woodland

By letter dated 27 March 1978, the City of Woodland generally concurred with the concept of the project but thought the construction and operating costs were understated. The letter provided numerous other specific comments which, as appropriate, were incorporated into the final feasibility report and EIS.

• Western Pacific Railroad Company

By letter dated 23 February 1978, the Western Pacific Railroad Company commented on improper designation of the Sacramento Northern Railway as Southern Pacific Railroad. Corrections have been made in the final report.

• Tooby Farms

By letter dated 5 April 1978, Tooby Farms expressed a concern over loss of a portion of its land in the northeast corner of the settling basin because of the project.

• Davis Audubon Society

By letter dated 5 April 1978, the Davis Audubon Society stated it was generally satisfied with the features of the project. The Audubon Society also stated that enlargement of the Clear Lake Outlet Channel had the potential to generate significant benefits to wildlife and that the wildlife refuge in the settling basin would serve as valuable habitat for migratory and resident birds as well as provide an excellent environmental education facility. Other specific comments have been incorporated into the final report and EIS.

• Sierra Club

By letter dated 23 April 1978, the Davis "Yolano" Group of the Mother Lode Chapter of the Sierra Club expressed its basic support for the project.

• Yolo County Flood Control and Water Conservation District

By letter dated 20 March 1978, the Yolo County Flood Control and Water Conservation District voiced its agreement with the final choices of alternatives with respect to Clear Lake flooding and lower basin sediment control. The letter stated that early in March 1978 litigation between the District and Lake County involving storage of water in Clear Lake had been resolved. However, questions of modification of the Gopcevic and Bemmerly Decrees remained unresolved. The letter further stated that such modification could not be expected until the Corps and the project sponsors can, with some finality, provide assurance that the position of parties involved will not be made worse because of the project. The letter also addressed additional points such as operation and maintenance of Clear Lake Dam and ground water recharge in Yolo County. In this report, the final EIS, and Sections C, D, and E of Appendix 1, information is presented which concludes that enlargement of the Clear Lake Outlet Channel will not detrimentally affect flooding, erosion, gravel mining operations, or ground water recharge in Yolo County. Other specific comments by the District have been incorporated into the final feasibility report and EIS.

• Yolo County

By letter dated 29 August 1978, the Yolo County Board of Supervisors voiced support for the proposed plans of improvement, subject to satisfying the concerns of landowners in Yolo County that enlargement of the Clear Lake Outlet Channel will not detrimentally affect them. Additional information verifying that Yolo County interests would not be negatively affected has been added to this report. The 29 August letter also provided the Board's intent to work toward modification of the Gopcevic and Bemmerly Court Decrees as necessary to allow implementation of the plans as proposed.

• Lake County Flood Control and Water Conservation District

By letter dated 13 June 1978, the Lake County Flood Control and Water Conservation District transmitted Resolution Number 78-175 by the Yolo County Board of Supervisors which strongly supported authorization and early construction of the proposed project in Lake County. The resolution, passed on 12 June 1978, also contained the necessary requirements of local cooperation sufficient for sponsorship of the Lake County portion of the project.

• State of California Reclamation Board

By letter dated 19 July 1978, the State of California Reclamation Board provided the necessary requirements of local cooperation sufficient for sponsorship of the Yolo County portion of the project.

By letters dated 2 January 1979 and 25 June 1979, the State of California Reclamation Board indicated its intent to provide necessary assurances for the Cache Creek Basin project if the President's proposed revised cost-sharing criteria are implemented.

The following individuals and organizations provided letters commenting on a preference for enlargement of the entire existing Clear Lake Outlet Channel as opposed to the proposed plan to enlarge only a portion of the outlet channel and construct a bypass channel. This report, the final EIS, and Sections D, E, and F of Appendix 1 describe in detail why, for social, economic, and environmental reasons, the proposed plan was selected over other alternatives.

Clear Lake Water Quality Council by letter dated 6 April 1978.
Clear Lake Water District by letter dated 29 March 1978.
Mr. John Jago by letter dated 29 March 1978.
Mr. Paul E. Racine by letter dated 28 March 1978.

• Mr. and Mrs. Sidney R. Sutton

By letter dated 24 March 1978, Mr. and Mrs. Sutton stated their support for the "No Action" alternative.

Review By Other Federal Agencies

Letters received from other Federal agencies expressing views and recommendations concerning the draft feasibility report and EIS are contained in Appendix 2 and summarized below.

- Advisory Council on Historic Preservation

By letter dated 8 March 1978, the Advisory Council on Historic Preservation stated that the Corps of Engineers understands its responsibilities regarding historic preservation requirements. They look forward to working with the Corps in carrying out these responsibilities in the future.

- Department of Agriculture, Soil Conservation Service

By letter dated 30 March 1978, the Soil Conservation Service (SCS) noted that there are no controversial items in the report within the realm of the Service's expertise and responsibilities and no conflict with any SCS ongoing or planned programs or projects.

- Department of Commerce

By letter dated 20 April 1978, the Department of Commerce furnished comments by the National Weather Service (NWS) that NWS provides a river and flood forecast and warning service for Cache Creek at Yolo, Capay and Rumsey, and Lakeport on Clear Lake. NWS felt these services should be referenced as a nonstructural approach to mitigating flood losses. In this report and Section D of Appendix 1, a discussion of flood forecasting as a nonstructural flood control alternative is included.

- Department of the Interior

Bureau of Indian Affairs

By letter dated 25 April 1978, the Bureau of Indian Affairs stated that it found no adverse impact upon any Indian lands under its jurisdiction.

Bureau of Mines

By letter dated 29 March 1978, the Bureau of Mines stated that minerals should be mentioned or acknowledged in the environmental statement. A discussion has been included in this report, the revised draft EIS, and Section B of Appendix 1.

Bureau of Land Management

By letter dated 20 April 1978, the Bureau of Land Management (BLM) notes that it estimates no major impact on BLM lands due to the project.

- Bureau of Reclamation

By letter dated 7 April 1978, the Bureau of Reclamation stated that those alternatives presented in the report are adequate to provide the various levels of protection noted in the document.

- Fish and Wildlife Service

By letter dated 3 May 1978, the Fish and Wildlife Service (FWS) mentioned its detailed report on the impacts of the project on fish and wildlife will soon be completed. FWS stated its full support for establishment of a National Wildlife Refuge in the Cache Creek Settling Basin. (Their detailed report has been completed and is included in Appendix 6.)

- Geological Survey

By letter dated 11 April 1978, the Geological Survey stated that it would be useful to include more specific information in the report concerning gravel excavation in Cache Creek channel. Although a great deal of additional specific information regarding gravel extraction has not been added to the report, an August 1976 report prepared by Woodward-Clyde Consultants for the Yolo County Planning Department may be useful. The report is entitled "Aggregate Extraction in Yolo County — A Study of Impacts and Management Alternatives."

- Heritage Conservation and Recreation Service

By letter dated 19 April 1978, the Heritage Conservation and Recreation Service stated the EIS adequately discusses impacts on recreation resources in the project area. Proposed improvements should substantially improve the quality and availability of passive and consumptive recreation opportunities and environmental education with only minor and temporary disturbances to existing recreation resources.

- National Park Service

By letter dated 4 April 1978, the National Park Service mentioned that additional information regarding cultural resources coordination and studies should be included in the final EIS. Such information has been included in the revised draft EIS.

- Department of Transportation

By letter dated 1 June 1978, the Department of Transportation noted that construction of new highway bridges near Clear Lake would not be eligible for Federal-aid highway funding and mentioned that it was verbally informed by the California Department of Transportation that construction of the new bridges was believed to be a Corps responsibility. The non-Federal sponsor of the project in upper Cache Creek Basin will pay for construction of the two new highway structures as a local cooperation requirement.

- Environmental Protection Agency

By letter dated 10 May 1978, the Environmental Protection Agency stated it had no objections to the proposed plan but believed additional information relative to air and water quality should be included in the EIS to allow the reviewer to fully assess the environmental impact of the project. Additional information requested has been incorporated into the final feasibility report and EIS.

Summary

Cache Creek Basin lies on the eastern slope of the Coast Range adjacent to the Eel River, Stony Creek, and Putah Creek Basins. The basin drains 1,150 square miles, including portions of Colusa, Lake, and Yolo Counties, and is naturally divided into two areas: the Clear Lake area, including tributaries to the lake, and the Cache Creek area, comprised of Cache Creek and its tributaries. The climate of the area is characterized by warm, dry summers with temperatures frequently exceeding 100 degrees and mild winters with temperatures seldom falling below freezing. The average annual precipitation, mostly falling between October and April, varies from 17 to 60 inches from the lower to the upper reaches of the basin and averages about 32 inches. Lake County, with a 1976 population of 27,600, ranks 41st in the State of California. Yolo County, with a 1976 population of 104,700, ranks 28th in California.

The major water resource related problem in the upper Cache Creek Basin is flooding on Clear Lake rim caused primarily by inadequate discharge capability of the lake's 5-mile-long outlet channel which discharges a maximum of about 8,000 cfs at extreme flood stage. Since historical flood inflows to the lake have at times exceeded 40,000 cfs, floodwater must be stored temporarily in the lake, thereby causing flooding along the shoreline. The most recent significant flooding occurred in 1958 and 1970. Damages incurred during the 1958 flood amounted to nearly $900,000 in 1958 prices. Damages in 1970 amounted to just under $500,000 in 1970 prices. The major water resource related problem in the lower basin is the large volume of sediment, which is transported by Cache Creek downstream to the Cache Creek Settling Basin. This basin was constructed in 1937 as a unit of the Sacramento River Flood Control Project to maintain floodflow capacity in the Yolo Bypass by controlling sediment inflow to the bypass. However, the storage capacity of the settling basin is now essentially exhausted, and sedimentation from Cache Creek has again become a problem. Cache Creek's heavy sediment load, about 675 acre-feet annually, is being carried into the Yolo Bypass, thus affecting the floodflow capacity of that unit of the Sacramento River Flood Control Project. Also, additional sediment flowing downstream compounds deposition problems in flood control and navigation channels such as the bypass, the Sacramento River Deep Water Ship Channel, and the San Francisco Bay system.

The plan selected to help alleviate flooding on Clear Lake rim includes widening and/or deepening 3.3 miles of the existing 5-mile-long Clear Lake Outlet Channel. Also, a 1.1-mile-long bypass channel would be constructed around the highly developed portion of the existing channel. The enlarged channel and bypass would conjunctively convey 8,000 cfs at a Clear Lake stage of 7.56 feet on the Rumsey gage at Lakeport. Also, future development would be required to flood proof or otherwise construct above the elevation of the preproject 100-year flood plane. The Gopcevic and Bemmerly Decrees would require some modification in order to implement this plan. The total first cost of this plan for the upper basin would be $6,050,000. The total average annual cost including interest, amortization, operation, and maintenance would be $413,000. With average annual monetary benefits of $1,205,900, consisting of flood damage reduction and NED employment benefits, the benefit-cost ratio of this portion of the project is 2.9 to 1.

The plan selected to best achieve the proper degree of sediment control in lower Cache Creek Basin consists of enlarging and raising the existing perimeter levees of the Cache Creek Settling Basin an average of 12 feet to provide 50 years of sediment storage capacity and enlarging existing levees of the settling basin upstream to County Road 102. The Cobble Weir would also be reconstructed and enlarged. The existing training levees would be degraded and rebuilt adjacent to the western perimeter levee. Also, the entire 3,600 acres within the basin would be purchased in fee, and a National Wildlife Refuge would be established. In addition, 50,000 cubic yards of sediment would annually be excavated for use as topsoil or other

agricultural benefit. The total first cost of this portion of the project is $11,910,000. The total average annual cost is $966,000 which includes interest, amortization, and operation and maintenance. With average annual benefits totaling $1,966,000, consisting of flood damage reduction benefits, sediment control benefits, wildlife enhancement, and NED employment benefits, this portion of the project provides a benefit-cost ratio of 2.0 to 1. Following authorization and post-authorization studies, and with adequate funding availability, it is estimated that both portions of the project could be constructed in 2 years.

With construction of the project in upper Cache Creek Basin, 79 acres, composed of grassland and several acres of riparian vegetation, would be affected. Temporary spoil area easements would total 80 acres. Two new bridges would be constructed over the bypass channel at State Highway 53 and old Highway 53. Numerous utilities would also have to be relocated. Channel excavation would require relocation of several residences and docks along the existing channel. In the lower portion of the basin, the entire 3,600 acres of the settling basin would be purchased in fee. This would require removing three dwellings in the northern portion of the settling basin and providing relocation assistance to the residents. Since levee enlargements would be on the waterside of the existing levee, no additional rights-of-way would be required beyond those currently held by the State of California. After construction, all scarred areas, including new levees and borrow areas, would be planted with native vegetation. In the upper portion of the Cache Creek Basin, the Federal Government would design and construct the project. Based on the President's proposed cost-sharing criteria, the total Federal first cost is estimated at $3,740,000. The non-Federal share of the total first cost of this portion of the project is estimated at $2,310,000. Non-Federal interests would also operate, maintain, and provide replacements for all project features at an estimated average annual cost of $11,400. They would be required to provide all lands, easements, and rights-of-way, hold and save the United States free from damages due to construction and operation of the project, adjust all claims regarding water rights that might be affected by flood control improvements, and require future development on Clear Lake rim to build above or otherwise flood proof to the elevation of the preproject 100-year flood plane. In the lower portion of the basin, the Federal Government would design and construct the project. Based on the President's proposed cost-sharing criteria, the Federal share of this portion of the project is estimated at $9,215,000. This includes $1,340,000 for wildlife enhancement, a portion of which is for lands that can be attributed to this project purpose. The non-Federal share of the total first cost of this portion of the project is $2,695,000. This includes $1.8 million for that portion of settling basin lands which can be attributed to sediment control. Non-Federal interests would also operate and maintain the sediment control portion of the project in a manner compatible with wildlife enhancement and management at an average annual cost of $19,100. They would also provide all easements and rights-of-way necessary for construction of the sediment control project. They would hold and save the United States free from damages due to construction and operation of the project, except for those due to the fault or negligence of the United States or its contractors; adjust all claims regarding water rights that might be affected by the project; and over the 50-year project life, remove a quantity of sediment from the Cache Creek Settling Basin equivalent to at least 50,000 cubic yards per year. The U.S. Fish and Wildlife Service would operate and manage the National Wildlife Refuge in a manner compatible with sediment control at an average annual cost of $125,000.

Conclusions

The District Engineer, Sacramento District Corps of Engineers, has reviewed and evaluated, in light of the overall public interest, the information contained in the environmental statement, other documents concerning the Cache Creek Basin, and views of other agencies, organizations, and individuals on environmental and other impacts of the plans for improvement of Cache Creek Basin. The District Engineer concurs in the recommendations of the U.S. Fish and Wildlife Service as set forth in the 1 August 1978 letter transmitting their Detailed Report. In addition, the District Engineer has personally inspected the project area and has participated in meetings with local Government officials, representatives of other agencies and organizations, and landowners and other concerned members of the public.

The possible consequences of enlarging the Clear Lake Outlet Channel and raising the perimeter levees of the existing Cache Creek Settling Basin and establishing a wildlife refuge were studied and evaluated for environmental effects, social well-being, engineering considerations, and economic factors. Specific attention was given to alleviating flood damages in the upper portions of Cache Creek Basin and controlling sediment in the lower basin, providing wildlife enhancement opportunities for lower Cache Creek Basin, and preserving natural esthetics of the area.

In conclusion, it has been found that the action proposed is based on a thorough evaluation of all viable alternatives. The project is in consonance with national policy, existing statutes, and administrative directives. Further, construction of the proposed project is supported by the State of California and Flood Control and Water Conservation Districts of Yolo and Lake Counties. The environmental statement meets or exceeds the requirements of the National Environmental Policy Act. The project will assist in promoting productive and enjoyable harmony between man and his environment.

Recommendations

It is recommended that modifications to the Clear Lake Outlet Channel in upper Cache Creek Basin and modification of the Cache Creek Settling Basin and creation of a National

Wildlife Refuge in lower Cache Creek Basin, described as the selected plans in this report, be authorized for Federal construction, with such modifications as in the discretion of the Chief of Engineers may be advisable, at a currently estimated Federal first cost of $13,753,000, provided that non-Federal interests will:

- Contribute a 5 percent cash share of the total first cost of the project, to be paid concurrently, and proportionately with the Federal contractual obligation for project construction.

- Provide all lands, easements, and rights-of-ways necessary for construction and maintenance of the flood damage reduction measures, including all relocations and alterations of buildings, roads, highways, bridges, sewers, and utilities (except for the settling basin lands which will be acquired in-fee by the Federal Government; non-Federal interests will be required to reimburse that portion of this cost attributable to those settling basin lands required for sediment control). Should the cost of lands, easements, rights-of-ways, and relocations exceed 20 percent of the cost of flood damage reduction measures, the Federal Government would reimburse local interests for all costs in excess of 20 percent.

- Pay or contribute in kind that portion of the cost of flood damage reduction measures which, when added to the cost of lands, easements, rights-of-way, and relocation, would amount to 20 percent of the cost of flood damage reduction measures.

- Maintain, operate, and replace project facilities after completion of the project in accordance with regulations prescribed by the Secretary of the Army, except for the wildlife refuge, and conduct sediment control operations in a manner compatible with wildlife enhancement.

- Hold and save the United States free from damages due to the construction and operation of the project, except for damages due to the fault or negligence of the United States or its contractors.

- Adjust all claims regarding water rights that might be affected by the project.

- Require future development on Clear Lake rim to build above or otherwise flood proof to the elevation specified under the National Flood Insurance Program. The specified elevation will be that in effect just prior to construction of the project.

- Over the 50-year project life of the Cache Creek Settling Basin, remove a quantity of sediment equivalent to at least 50,000 cubic yards per year.

Donald M. O'Shei

DONALD M. O'SHEI
Colonel, CE
District Engineer

TABLE 1

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS

ALTERNATIVES	FLOOD PROOFING FUTURE FACILITIES	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (SELECTED PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (NATIONAL ECONOMIC DEVELOPMENT PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND MODIFIED BYPASS (ENVIRONMENTAL QUALITY PLAN)	NO ACTION
I. PLAN DESCRIPTION	Local flood regulatory authority applied to insure proper land use within flood zone. Flood proof future development within standard project flood plain (once in 400 years on the average). Presently Lake County participating in National Flood Insurance Program which requires flood proofing up to 100-year level. Expenses for flood proofing borne by individual property owners.	Enlarge 3.3 miles of outlet channel from capacity of 2,500 to 8,000 cfs at 7.56 feet on Rumsey gage at Lakeport and construct 1.1-mile bypass channel. Plant riparian vegetation along bypass channel. Flood operation criteria function of non-damaging flow of 20,000 cfs at downstream town of Rumsey and control lake stage to 7.56 feet on Rumsey gage at Lakeport. Construct two new bridges. Minimal impact on riparian development. Modification of Bemmerly and Gopcevic Dacreas necessary prior to plan implementation.	Same as previous plan, except omit planting of riparian vegetation along bypass.	Enlarge 3.0 miles of outlet channel from a capacity of 2,500 to 8,000 cfs at 7.56 feet on Rumsay gage at Lakeport and construct new 1.6-mile bypass channel and control structures. Plant riparian vegetation along bypass channel. Flood operation criteria function of non-damaging flow of 20,000 cfs at downstream town of Rumsay and control lake stage to 7.56 feet on Rumsay gage at Lakeport. Purchase 560 acres of Anderson Marsh to preserve worth as natural resource. Construct two new bridges. Minimal impact on riparian development. Modification of Bemmerly and Gopcevic Decreas necessary prior to plan implementation.	No action undertaken by Federal Government for flood damage reduction through structural measures.
II. PLAN EVALUATION					
A. Contributions to Planning Objectives					
1. Flood Control	Flood proofing consists of elevating future buildings on pads or piles, constructing dikes, providing watertight closures and anchorage systems, waterproofing, or other such methods designed to resist inundation.	Provide flood protection for homes, commercial developments, and agricultural crops that encircle rim of Clear Lake by increasing the outflow capacity of Clear Lake outlet channel and maintaining current zoning requirements.	Same as Previous Alternative.	Same as Previous Alternative.	- -
B. Relationship to National Accounts (System of Accounts)					
1. NED					
a. Beneficial Impacts					
(1) Value of Increasing Outputs of Goods and Services					
(a) Flood Control	$242,100	$1,170,200	$1,170,200	$1,170,200	- -
(b) NED Employment Benefits		$ 35,700	$ 34,000	$ 45,900	- -
(2) Total Annual Benefits	$242,100	$1,205,900	$1,204,200	$1,216,100	- -
b. Adverse Impacts					
(1) Total Project First Cost		$6,050,000	$5,870,000	$7,324,000	- -
*(2) Annual Project Cost	$ 78,800	$ 413,000	$ 397,600	$ 495,900	- -
c. Net Benefits	$163,300	$ 792,900	$ 806,600	$ 720,200	- -
d. Benefit-Cost Ratio		2.9 to 1.0	3.0 to 1.0	2.5 to 1.0	

Index of Footnotes

Timing
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2. *Impact is expected within 15 years following plan implementation.*
3. *Impact is expected in a longer time frame (15 or more years following implementation).*

Uncertainty
4. *The uncertainty associated with the impact is 50% or more.*
5. *The uncertainty is between 10% and 50%.*
6. *The uncertainty is less than 10%.*

Exclusivity
7. *Overlapping entry; fully monetized in NED account.*
8. *Overlapping entry; not fully monetized in NED account.*

Actuality
9. *Impact will occur with implementation.*
10. *Impact will occur only when specific additional actions are carried out during implementation.*
11. *Impact will not occur because necessary additional actions are lacking.*

Location of Impacts
12. *Within the immediate planning area.*
13. *Within the study area.*
14. *Within a larger area affected by the project.*
15. *Within the rest of the nation.*

Measure of Impacts
16. *Significant*
17. *Insignificant*

Section 122
*Items specifically required in Section 122 and ER 1105-2-240.

TABLE I

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	FLOOD PROOFING FUTURE FACILITIES	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (SELECTED PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (NATIONAL ECONOMIC DEVELOPMENT PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND MODIFIED BYPASS (ENVIRONMENTAL QUALITY PLAN)	NO ACTION
2. Environmental Quality					
a. Environmental Quality Enhanced					
*(1) Enhance Aesthetics of Area Protected from Floods	Potential reduction of development in Clear Lake flood plain would reduce loss of shoreline vegetation. (2,5,8,10,13,17)	1.1-mile long-bypass channel would create new riparian vegetation along banks. Additional riparian vegetation planted. Vegetation disturbed by enlargement of existing channel replanted. Natural grasses in borrow area would be reestablished. (1,6,7,9,12,16)	1.1-mile-long bypass channel would create new riparian vegetation along banks. Vegetation disturbed by enlargement of existing channel replanted. (1,6,7,9,12,16)	Same as "Enlarge Clear Lake Outlet Channel and Bypass" plan except bypass is 1.6-mile-long. Also purchase 560 acres of Anderson Marsh to protect the four biogeographical units which collectively form its ecosystem, i.e., marsh, littoral zone, woodland, and chaparral. (1,6,7,9,14,16)	- -
(2) Protection of Existing Wildlife Habitat	Potential reduction in development in the Clear Lake flood plain area would reduce the loss of shoreline wildlife habitat. (2,5,8,10,13,16)	Project designed so as not to disturb aquatic oxbow habitat. 1.1 miles of new channel capable of supporting aquatic life would be created. (1,6,8,9,12,16)	Same as Previous Alternative.	Same as "Enlarge Clear Lake Outlet Channel and Bypass" plan except bypass channel is 1.6-miles long. Also purchase 560 acres of Anderson Marsh would aid in preservation of several species of mammal, 28 species of fish, and 91 species of bird which are known to utilize the area. 3 of the bird species are considered "rare or endangered." (1,6,7,9,14,16)	Fishery on Clear Lake and outlet channel will remain stable. Wildlife populations would remain stable.
b. Environmental Quality Degraded					
*(1) Existing Vegetation Lost	Possible increased development outside the flood plain will increase the loss of vegetation in that area. (2,5,8,10,13,16)	71 acres grassland lost to bypass channel construction. 3 acres riparian land along 3.3-mile reach of existing channel lost to channel widening. This land supports vegetation such as hardwoods, pines, willows, vines and brush species. (1,6,7,9,12,16)	Same as Previous Alternative	Same as previous alternative except bypass is 1.6 miles long and 100 acres grassland lost to bypass channel construction.	Long term decrease in vegetation along lake periphery outlet channel due to replacement of open space and agricultural land with urban development.
*(2) Water Quality	No Effect	Increased turbidity during one construction season within outlet channel and downstream of Clear Lake outlet dam. No impact on algal growth problem in Clear Lake. (1,6,8,9,13,17)	Same as Previous Alternative	Same as Previous Alternative	Continued development could cause a long-term reduction in water quality in Clear Lake and Cache Creek. Continued algal problem in Clear Lake.
(3) Air Quality	No Effect	Minor effect by construction equipment exhaust during 1-1/2 construction seasons. (1,6,8,9,13,17)	Same as Previous Alternative	Same as Previous Alternative	- -
3. Social Well-Being					
a. Beneficial Impacts					
(1) Health, Safety and Community Well-Being	Flood proofing would increase protection to future development from the public safety hazards associated with flooding. (2,5,8,10,13,16)	Safety hazard during construction minimized due to bypassing the most densely populated areas by bypass channel. Project would decrease health hazards associated with flooding along lake rim and outlet channel. (1,6,7,9,13,16)	Same as Previous Alternative	Same as Previous Alternative	Newly planned sanitation and water supply systems will reduce public health threat posed by flooding.
*(2) Improvement of Community Cohesion	Flood proofing, although bringing on higher construction costs, would result in a more uniform cost and better quality home within the flood plain. (2,6,8,10,13,16)	Dislocation of persons due to flooding reduced. Long-term stabilizing effect on housing around lake and along outlet channel. (2,6,8,9,13,16)	Same as Previous Alternative	Same as Previous Alternative	- -
(3) Transportation	No Effect	A long-term benefit would be realized to roads along Clear Lake rim by reducing the flood threat. (2,6,8,9,13,16)	Same as Previous Alternative	Same as Previous Alternative	Two new state highway routes are proposed for future construction.
*(4) Improvement of Leisure Activities	No Effect	Effect on riparian recreation oriented development minimized with bypass channel. Minor fishery would be supported in bypass channel. Stabilizing affect on recreation development on lake rim. (2,6,7,9,13,16)	Same as Previous Alternative	Same as previous alternative plus preservation of habitat within Anderson Marsh will insure a continuation of associated recreation. (1,6,7,9,13,16)	4,780,000 annual user days predicted for Clear Lake by year 2020.

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Location of Impacts
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13. *Within the study area.*
14. *Within a larger area affected by the project.*
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Measure of Impacts
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17. *Insignificant*

Section 122
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SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	FLOOD PROOFING FUTURE FACILITIES	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (SELECTED PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (NATIONAL ECONOMIC DEVELOPMENT PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND MODIFIED BYPASS (ENVIRONMENTAL QUALITY PLAN)	NO ACTION
(5) Improvement of Public Facilities	Land use regulations help preserve any "natural" appearance remaining on the lake periphery in restraining development of shoreline and minimizing landscape alterations. *(1,6,8,9,12,16)*	Aesthetic losses minimized by use of bypass channel, thereby permitting scenic oxbow areas to remain unaffected, and reducing loss of riparian vegetation along existing channel. Potentially scenic source of new riparian vegetation created along bypass. *(1,6,7,9,12,16)*	Same as Previous Alternative	Same as Previous Alternative	- -
b. Adverse Impacts					
(1) Community Cohesion	Higher construction costs associated with flood proofing would increase problem of shortage of low to moderate income housing. *(1,5,8,9,13,16)*	No Effect	No Effect	No Effect	Major flood damage to existing structures along lake rim and outlet channel would continue to occur.
*(2) Displacement of People	- - - -	Ten residences relocated. *(1,6,7,9,12,16)*	Same as Previous Alternative	Same as Previous Alternative	Evacuation during flooding will continue.
(3) Transportation	Continued flood threat to existing roads and utilities around Clear Lake periphery. *(1,6,7,9,13,16)*	Reconstruction of 2 new additional bridges on State Highway 53 and old Highway 53 would temporarily affect transportation efficency at these sites. *(1,6,7,9,12,16)*	Same as Previous Alternative	Same as Previous Alternative	Continued flood threat to existing roads and utilities around Clear Lake periphery.
(4) Noise	No Effect	Minor effect due to construction equipment during one construction season. *(1,6,8,9,12,17)*	Same as Previous Alternative	Same as Previous Alternative	Increased urban development and recreation use would increase noise levels, but not to unacceptable levels.
*(5) Cultural Resources	No Effect	Wintun and Pomo Indian Villages and Campsites line the periphery of Clear Lake and the outlet channel. Construction works could disturb such sites should they exist. *(1,6,7,9,12,16)*	Same as Previous Alternative	Same as Previous Alternative	Continued urbanization and agricultural improvements would progressively diminish the rich archeological resources available.
(6) Institutional Relationships	No Effect	Modification of Gopcevic (1920) and Bemmerly (1940) Decrees necessary prior to outlet channel alteration. *(1,6,7,9,13,16)*	Same as Previous Alternative	Same as Previous Alternative	- -
4. Regional Development					
a. Beneficial Impacts					
(1) Value of Increased Income	Damage reduction to future structural development will increase assessed valuation around lake. *(2,5,8,9,13,17)*	Flood plain property values would increase, increasing local tax revenues. Reduced emergency flood fighting costs. *(1,6,8,9,13,16)*	Same as Previous Alternative	Same as Previous Alternative	Riparian property values would increase, providing additional tax revenue.
(2) Quantity of Increased Employment	No Effect	Reduced flood threat would stabilize existing and promote future development, resulting in similar stabilizing effect on local labor force. 21 local workers provided with employment during 1-1/2 construction seasons. Maintenance work required intermittently after construction employing local labor. *(1,6,7,9,13,16)*	Same as Previous Alternative (except 21 local workers provided employment)	Same as Previous Alternative (except 29 local workers provided employment)	Changes expected to follow rate of population growth. Employment more dependent on commercial trade and services than at present.
(3) Increased Business and Industrial Activity		Retail sales of about $480,000 would benefit local business during construction period. Long-term benefits also realized. *(1,6,7,9,13,16)*	Same as Previous Alternative	Retail sales of about $475,000 would benefit local business during construction period. Long-term benefits also realized. *(1,6,7,9,13,16)*	- -
b. Adverse Impacts					
(1) Value of Income Lost	Administration and enforcement of non-structural regulations would be local government costs. *(1,6,7,9,13,16)*	79 acres of land removed from tax rolls, reducing tax revenues by about $6,800 annually. *(1,6,7,9,13,16)*	79 acres of land removed from tax rolls, reducing tax revenues by about $6,800 annually. *(1,6,7,9,13,16)*	79 acres of land removed from tax rolls, reducing tax revenues by about $6,800 annually. *(1,6,9,13,16)*	- -

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Location of Impacts
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13. *Within the study area.*
14. *Within a larger area affected by the project.*
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Measure of Impacts
16. *Significant*
17. *Insignificant*

Section 122
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TABLE I

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	FLOOD PROOFING FUTURE FACILITIES	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (SELECTED PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (NATIONAL ECONOMIC DEVELOPMENT PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND MODIFIED BYPASS (ENVIRONMENTAL QUALITY PLAN)	NO ACTION	Index of Footnotes
(2) Business and Industrial Activity	Flood proofing would raise costs of 64 new commercial structures and replacement of 131 existing structures in standard project flood plain between 1985 and 2035. Continued flood damage to existing facilities. (2,6,7,9,13,16)	During construction period, recreation oriented business along outlet channel adversely affected. (1,6,8,9,12,16)	Same as Previous Alternative	Same as Previous Alternative	Commercial and agricultural development would continue to suffer periodic flood damage. Agricultural development would be highly dependant upon development of new water supplies.	*Timing* 1. *Impact is expected to occur prior to or during implementation of the plan.* 2. *Impact is expected within 15 years following plan implementation.* 3. *Impact is expected in a longer time frame (15 or more years following implementation).* *Uncertainty* 4. *The uncertainty associated with the impact is 50% or more.* 5. *The uncertainty is between 10% and 50%.* 6. *The uncertainty is less than 10%.* *Exclusivity* 7. *Overlapping entry; fully monetized in NED account.* 8. *Overlapping entry; not fully monetized in NED account.* *Actuality* 9. *Impact will occur with implementation.* 10. *Impact will occur only when specific additional actions are carried out during implementation.* 11. *Impact will not occur because necessary additional actions are lacking.* *Location of Impacts* 12. *Within the immediate planning area.* 13. *Within the study area.* 14. *Within a larger area affected by the project.* 15. *Within the rest of the nation.* *Measure of Impacts* 16. *Significant* 17. *Insignificant* *Section 122* **Items specifically required in Section 122 and ER 1105-2-240.*
(3) Land Use	Additional cost of flood proofing may discourage development in flood prone areas around lake. Future development not directly related to recreation may locate outside standard project flood plain due to increased cost. (2,5,8,9,13,16)	74 acres of grassland and riparian land lost by channel construction and widening. 80 acres of pastureland used for spoil area to be located outside of flood plain to prevent induced development. (1,6,7,9,12,16)	Same as Previous Alternative	100 acres of grassland and riparian land lost by channel construction and widening. 80 acres of pasture land used for spoil area to be located outside of flood plain to prevent induced development. (1,6,7,9,12,16)	Urban development will replace agricultural use of land. Development along lake rim restricted by perennial flood threat	
C. Plan Response to Associated Evaluation Criteria.						
1. Acceptability	Medium	High	High	Medium	Low	
2. Stability	High	High	High	Medium	Low	
III. IMPLEMENTATION RESPONSIBILITY						
A. Corps of Engineers	None	Design, prepare detailed plans and specifications, and construct project.	Same as Previous Alternative	Same as previous plan plus provide 100% of cost to purchase 560 acres of Anderson Marsh to preserve that natural ecosystem.	- -	
B. Local Sponsor	Administration and enforcement of non-structural regulations.	Provide all costs for lands, easements, rights-of-way, and relocations, operate and maintain completed facilities for project life.	Same as Previous Alternative	Same as Previous Alternative	- -	

TABLE 2

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
SEDIMENT CONTROL ALTERNATIVE PLANS

ALTERNATIVES	RAISE SETTLING BASIN LEVEES (ENVIRONMENTAL QUALITY PLAN)	RAISE SETTLING BASIN LEVEES (NATIONAL ECONOMIC DEVELOPMENT PLAN, SELECTED PLAN)	NO ACTION
I. PLAN DESCRIPTION	Raise existing settling basin perimeter levees an average of 13 feet to provide 17,000 acre-feet of sediment storage. Reconstruct and enlarge existing cobble weir. Raise weir crest in 2-foot increments with stop logs over project life to maintain 50% trap efficiency. Degrade training levees. Reconstruct training levee adjacent to west perimeter levee to allow maximum utilization of all land within the basin. Purchase in fee the 3,600 acres within the settling basin and establish a wildlife refuge. Operate basin in a dual capacity of sediment control and wildlife enhancement. No provision for excavation of sediment from sediment basin. 50-year project life.	Raise existing settling basin perimeter levees an average of 12 feet to provide 15,500 acre-feet of sediment storage. Reconstruct and enlarge existing cobble weir. Raise weir crest in 2-foot increments with stop logs over project life to maintain 50% trap efficiency. Degrade training levees. Reconstruct training levees adjacent to west perimeter levee to allow maximum utilization of all land within the basin. Purchase in fee the 3,600 acres within the settling basin and establish a wildlife refuge. Operate basin in a dual capacity of sediment control and wildlife enhancement. Annually excavate about 50,000 cubic yards from basin for use by local topsoil distributors and maximum quantities for other uses as demand is established over project life.	No action undertaken by Federal Government for sediment control or erosion reduction through structural or non-structural measures.
II. PLAN EVALUATION			
A. Contributions To Planning Objectives			
1. Flood Control	Intercept 50% of the 1.2 million cubic yards of sediment that, on the average, annually flow into the settling basin, thus maintaining Yolo Bypass floodflow capacity.	Same as previous alternative except project life could be extended if substantial demands are established for future sediment excavation.	Deposition of Cache Creek sediments in the Yolo Bypass will, on an increasing basis impair the capability of that unit of the Sacramento River Flood Control Project to convey design floodflows.
2. Sediment Control	Intercept a major portion of sediment that currently flows into Yolo Bypass, downstream ship channels, and San Francisco Bay, thus reducing costly dredging operations.	Same as previous alternative except project life could be extended if substantial demands are established for future sediment excavation.	More frequent dredging of the Sacramento River, ship channels and San Francisco Bay required to maintain their operating ability.
3. Environmental Enhancement	Provides for the establishment of a wildlife refuge over the entire settling basin.	Same as previous alternative except that up to 500 acres over a 5-year period will be excavated, causing temporary loss of vegetation on those lands. Large scale excavation at later date as demands are established could temporarily disrupt refuge operation.	- -
B. Relationship To National Accounts (System of Accounts)			No Federal or Non-Federal costs and no benefits.
1. NED			
a. Beneficial Impacts			
(1) Value of Increased Output of Goods and Services			- -
(a) Flood Control	$ 1,114,300	$ 1,114,300	
(b) Sediment Control	$ 268,000	$ 268,000	
(c) Recreation	$ 145,000	$ 145,000	
(d) Wildlife Refuge	$ 282,000	$ 282,000	
(e) Crop Depradation	$ 75,000	$ 75,000	
(f) NED Employment Benefits	$ 89,400	$ 81,700	
(2) Total Annual Benefits	$ 1,973,700	$ 1,966,000	- -
b. Adverse Impacts			
(1) Total Project First Costs	$12,682,000	$11,910,000	- -
(2) Total Annual Project Costs	1,020,000	966,600	- -
c. Net Benefits	953,700	999,400	
d. Benefit-To-Cost Ratio	1.9 to 1.0	2.0 to 1.0	

Index of Footnotes

Timing

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2. *Impact is expected within 15 years following plan implementation.*
3. *Impact is expected in a longer time frame (15 or more years following implementation).*

Uncertainty

4. *The uncertainty associated with the impact is 50% or more.*
5. *The uncertainty is between 10% and 50%.*
6. *The uncertainty is less than 10%.*

Exclusivity

7. *Overlapping entry: fully monetized in NED account.*
8. *Overlapping entry: not fully monetized in NED account.*

Actuality

9. *Impact will occur with implementation.*
10. *Impact will occur only when specific additional actions are carried out during implemenentation.*
11. *Impact will not occur because necessary additional actions are lacking.*

Location of Impacts

12. *Within the immediate planning area.*
13. *Within the study area.*
14. *Within a larger area affected by the project.*
15. *Within the rest of the nation.*

Measure of Impacts

16. *Significant*
17. *Insignificant*

Section 122

**Items specifically required in Section 122 and ER 1105-2-240.*

TABLE 2

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
SEDIMENT CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	RAISE SETTLING BASIN LEVEES (ENVIRONMENTAL QUALITY PLAN)	RAISE SETTLING BASIN LEVEES (NATIONAL ECONOMIC DEVELOPMENT PLAN, SELECTED PLAN)	NO ACTION
2. Environmental Quality			
a. Environmental Quality Enhanced			
(1) Enhance Aesthetics of Area Protected From Flooding	Reduce inundation area from potential floods by 100,000 plus acres. Levees will be seeded with grasses to restore original condition. *(2,6,7,9,13,16)*	Same as Previous Alternative.	- -
(2) Creation of Wildlife Area	3,600 acres of land, currently being used for agricultural purposes, would be converted to a wildlife refuge, significantly enhancing wildlife production in Sacramento Basin. *(1,6,7,9,14,16)*	Same as Previous Alternative.	- -
(3) Preservation of Open Space	- - -	Sediment to be excavated for fill from the basin would reduce demand in other areas, thereby reducing the amount of land scarring outside the settling basin. *(2,5,8,10,12,17)*	- -
(4) Improvement of Stream Aesthetics	Decrease by 335 acre-feet annually the amount of sediment passing into the Yolo Bypass and downstream ship channels, thereby decreasing turbidity. *(1,6,8,9,14,17)*	Same as Previous Alternative.	- -
b. Environmental Quality Degraded			
*(1) Vegetation Lost Due to Project Construction	250 acres of cropland permanently sacrificed to right-of-way. Temporary loss of 260 acres of vegetation to be used as a borrow site during construction. *(1,6,7,9,12,17)*	Same as Previous Alternative.	- -
(2) Wildlife	Insignificant disruption of local wildlife population during two season construction period. *(1,6,9,12,17)*	Same as previous alternative plus periodic disruption of local wildlife populations during annual sediment removal operations.	Continued lack of a fishery in lower Cache Creek. High turbidity levels in Yolo Bypass and downstream due to sediment inflow.
(3) Water Quality	No Effect	No Effect	No Significant Change.
(4) Air Quality	Minor effect of construction equipment exhaust during two season construction period. *(1,6,9,12,17)*	Same as Previous Alternative.	No Significant Change.
3. Social Well-Being			
a. Beneficial Impacts			
(1) Enhancement of Safety and Community Well-Being	Increase freeboard from three feet to five feet on levees surrounding the settling basin thus increasing the protection from flooding in that area. Increased levee height, which increases the storage capacity of the settling basin, decreases the amount of sediment allowed to flow into the Yolo Bypass thereby decreasing the chances of failure of Yolo Bypass Levees. *(2,6,9,13,16)*	Same as previous alternative but to a greater extent because of the annual sediment removal operations.	- -
*(2) Displacement of People	Periodic evacuation during periods of flooding would be reduced. *(2,6,9,13,17)*	Same as Previous Alternative.	- -
*(3) Improvement of Community Cohesion	Reduce threat of failure of Yolo Bypass levees that would cause widespread flood damage and possible loss of life. *(2,6,9,14,16)*	Same as previous alternative but to a greater extent.	- -
(4) Enhancement of Health	Reduce contamination of local water supply by flood waters. *(2,6,13,16)*	Same as Previous Alternative.	- -
(5) Transportation	Decrease by 240 acre-feet annually the amount of sediment allowed to deposit in the Sacramento River shipping channel and the San Francisco Bay. *(1,6,7,9,14,16)*	Same as previous alternative plus potentially decrease road construction costs by making available inexpensive fill material.	- -
(6) Improvement of Leisure Activities	Creation of a wildlife refuge over the settling basin will produce an estimated 46,000 recreation user days annually for hunting, fishing, camping and wildlife observation. *(1,5,10,13,16)*	Same as Previous Alternative.	Cache Creek "white water" boating would increase. Recreation facilities will be developed to handle future use.
(7) Improvement of Public Facilities	Wildlife refuge establishment would restore area to relatively natural state, resulting in a long term aesthetic increase. *(1,6,9,12,16)*	Same as Previous Alternative.	- -
b. Adverse Impacts			
(1) Noise	Minor effect due to construction equipment during two-season construction period. *(1,6,12,17)*	Same as previous alternative plus during annual sediment removal operations.	Noise would increase corresponding to population, industrial and commercial development.

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5. *The uncertainty is between 10% and 50%.*
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Exclusivity

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8. *Overlapping entry; not fully monetized in NED account.*

Actuality

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10. *Impact will occur only when specific additional actions are carried out during implementation.*
11. *Impact will not occur because necessary additional actions are lacking.*

Location

12. *Within the immediate planning area.*
13. *Within the study area.*
14. *Within a larger area affected by the project.*
15. *Within the rest of the nation.*

Measure of Impacts

16. *Significant*
17. *Insignificant*

Section 122

**Items specifically required in Section 122 and ER 1105-2-240.*

TABLE 2

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
SEDIMENT CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	RAISE SETTLING BASIN LEVEES (ENVIRONMENTAL QUALITY PLAN)	RAISE SETTLING BASIN LEVEES (NATIONAL ECONOMIC DEVELOPMENT PLAN, SELECTED PLAN)	NO ACTION
*(2) Community Cohesion	- - -	- - -	No action will result in continued flood damage and possible loss of life.
*(3) Displacement of People	Three relocations necessary as a result of project construction. *(1.6.12.17)*	Same as Previous Alternative.	No action will result in continued evacuation of threatened residences during floods.
(4) Health	No Effect	No Effect	Contamination of local water supply during floods will remain a possibility.
(5) Transportation	No Effect	No Effect	Channel meander and continued erosion would threaten existing and future transportation systems by undermining bridge piers and abutments, as well as travel ways themselves.
(6) Leisure Activities	Existing private hunting clubs in settling basin would be abolished with establishment of a wildlife refuge. *(1.6.8.P.12.16)*	Same as Previous Alternative.	- -
(7) Public Facilities	Temporary aesthetic loss due to construction scars. *(1.6.9.12.17)*	Same as previous alternative plus scarring of land annually for sediment removal operations.	Increased residential development would destroy some "natural" aesthetic value. Continued channel erosion and gravel mining operations would continue to deteriorate the riparian appearance of Cache Creek.
(8) Historic and Archeologic	Wintun and Pomo Indian archeologic sites known to exist throughout the Cache Creek Basin could be disturbed by project construction. Levees would be built, however, from recently deposited sediment. A more complete archeological survey of the area would be made prior to congressional authorization of the project. *(1.5.13.17)*	Same as Previous Alternative.	Known archeologic resources in lower basin may be lost to continued erosion and development such as land leveling and urban buildup.
4. Regional Development			
a. Beneficial Impacts			
*(1) Value of Increased Income	$8,000 to $10,000 annually rebated under revenue sharing agreement when lands are taken for national wildlife refuge. Increased retail sales during two-year construction period would increase local tax revenue by about $3,900. Additional retail sales expected due to activity associated with refuge management. *(1.6.8.9.13.16)*	Same as previous alternative plus additional retail sales expected due to activity associated with annual sediment removal operations.	Higher developed land uses would raise property values, and thus tax revenues.
*(2) Quantity of Increased Employment	Estimated 90 workers would be acquired from the local labor force during the two-year construction period. Increased activity associated with outdoor recreation could favorably effect local employment. *(1.5.8.9.13.16)*	Same as previous alternative plus annual sediment removal operations would favorably effect local mining operators.	- -
*(3) Increased Business and Industrial Activity	Local retail sales increased $1,050,000 during construction. Local recreation-oriented business should increase. *(1.5.8.9.12.16)*	Same as previous alternative plus commercial soil mining operations effectively serviced by soil trapped within the basin.	- -
(4) Land Use	No Effect	Reduction in crop depredation on lands outside the settling basin.	- -
b. Adverse Impacts			
(1) Value of Income Lost	3,600 acres taken from county tax rolls would decrease county revenues by $90,000 annually. *(1.6.8.P.12.16)*	Same as Previous Alternative.	Lands sacrificed to continued erosion will be lost to county tax rolls. Crop depredation from wildlife would continue to be a problem.
(2) Employment/Labor Force	No Effect	No Effect	Employment in agriculture is expected to decline, with high growth rate in local government, finance, services, trade, construction, and manufacturing.
(3) Agricultural Activity	No Effect	No Effect	Based on current water available, maximum irrigable acreage possible in sub-basin is 58,000 acres. New agricultural development would be subject to this restriction. Continued erosion in Cache Creek would cause further loss of agricultural land.
(4) Land Use	250 acres of agricultural land lost to levee construction and an additional 260 acres temporarily taken from crop production to serve as a borrow area. *(1.6.7.P.12.17)*	Same as Previous Alternative.	- -

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Location of Impacts
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13. *Within the study area.*
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Measure of Impacts
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17. *Insignificant*

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SEDIMENT CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	RAISE SETTLING BASIN LEVEES (ENVIRONMENTAL QUALITY PLAN)	RAISE SETTLING BASIN LEVEES (NATIONAL ECONOMIC DEVELOPMENT PLAN, SELECTED PLAN)	NO ACTION
C. Plan Response to Associated Evaluation Criteria			
1. Acceptability	High	High	Low
2. Stability	High	High	Low
III. IMPLEMENTATION RESPONSIBILITY			
A. Corps of Engineers	Design, prepare detailed plans and specifications for, and construct project. Provide all costs of lands and initial facilities for wildlife refuge.	Same as Previous Alternative	- -
B. U.S. Fish & Wildlife Service	Provide all costs for future facilities for wildlife refuge. Operate and maintain refuge throughout project life in a manner compatible with sediment control.	Same as Previous Alternative	- -
C. State of California	Provide all costs for lands, easements, rights-of-way, and relocations attributable to sediment control. Operate and maintain project in a manner compatible with refuge management.	Same as previous alternative, plus arrange for periodic stockpiling and annual disparsal of 50,000 cubic yards of sediment. Actively seek other means to disperse sediment over project life.	- -

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Section 122

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TABLE 3
ECONOMICS OF ALTERNATIVES CONSIDERED FURTHER

ALTERNATIVE	FIRST COST (Dollars)				ANNUAL COSTS (Dollars)			ANNUAL BENEFITS (Dollars)							BENEFIT-COST RATIO
	CONSTRUCTION	LANDS AND RELOCATIONS	RECREATION FACILITIES	TOTAL	MAINTENANCE, OPERATION AND REPLACEMENT	FLOOD ZONING	TOTAL**	FLOOD CONTROL	SEDIMENT CONTROL	WILDLIFE ENHANCEMENT	RECREATION	CROP DEPREDATION	NED EMPLOYMENT BENEFITS	TOTAL	
FLOOD CONTROL															
1. Flood proofing future facilities						78,800	78,800	242,100						242,100	3.1 to 1.0
2. Enlarge Clear Lake outlet channel	5,916,000	2,760,000		8,676,000	14,675		587,000	1,170,200***					56,400	1,226,600	2.1 to 1.0
3. Enlarge Clear Lake outlet channel and bypass (Selected Plan)	3,740,000	2,310,000		6,050,000	11,400		413,000	1,170,000***					35,700	1,205,900	2.9 to 1.0
4. Enlarge Clear Lake outlet channel and bypass (NED Plan)	3,565,000	2,310,000		5,875,000	7,700		397,600	1,170,200***					34,000	1,204,200	3.0 to 1.0
5. Enlarge Clear Lake outlet channel, modified bypass and Anderson Marsh (EQ Plan)	4,807,000	2,517,000*		7,324,000	9,400		495,900	1,170,200***					45,900	1,216,100	2.5 to 1.0
6. No action															
SEDIMENT CONTROL															
1. Raise settling basin levees and establish a wildlife refuge (EQ Plan)	8,992,000	3,130,000	560,000	12,682,000	144,100		1,020,000	1,114,300	268,000	282,000	145,000	75,000	89,400	1,973,700	1.9 to 1.0
2. Raise levees, establish a refuge and excavate settling basin (NED and Selected Plans)	8,220,000	3,130,000	560,000	11,910,000	144,100		966,600	1,114,300	268,000	282,000	145,000	75,000	81,700	1,966,000	2.0 to 1.0
3. Raise levees and excavate settling basin (with agriculture)	8,220,000	3,130,000		11,350,000	19,100		626,000****	1,114,300	268,000				81,700	1,464,000	2.3 to 1.0
4. No action															

*212,000 of this amount is for the purchase of Anderson Marsh lands.

**Includes interest and amortization over 100 years for flood control and 50 years for sediment control.

***Includes 129,600 by requiring future development to flood proof to pre-project as opposed to post-project 100-year flood plain elevation.

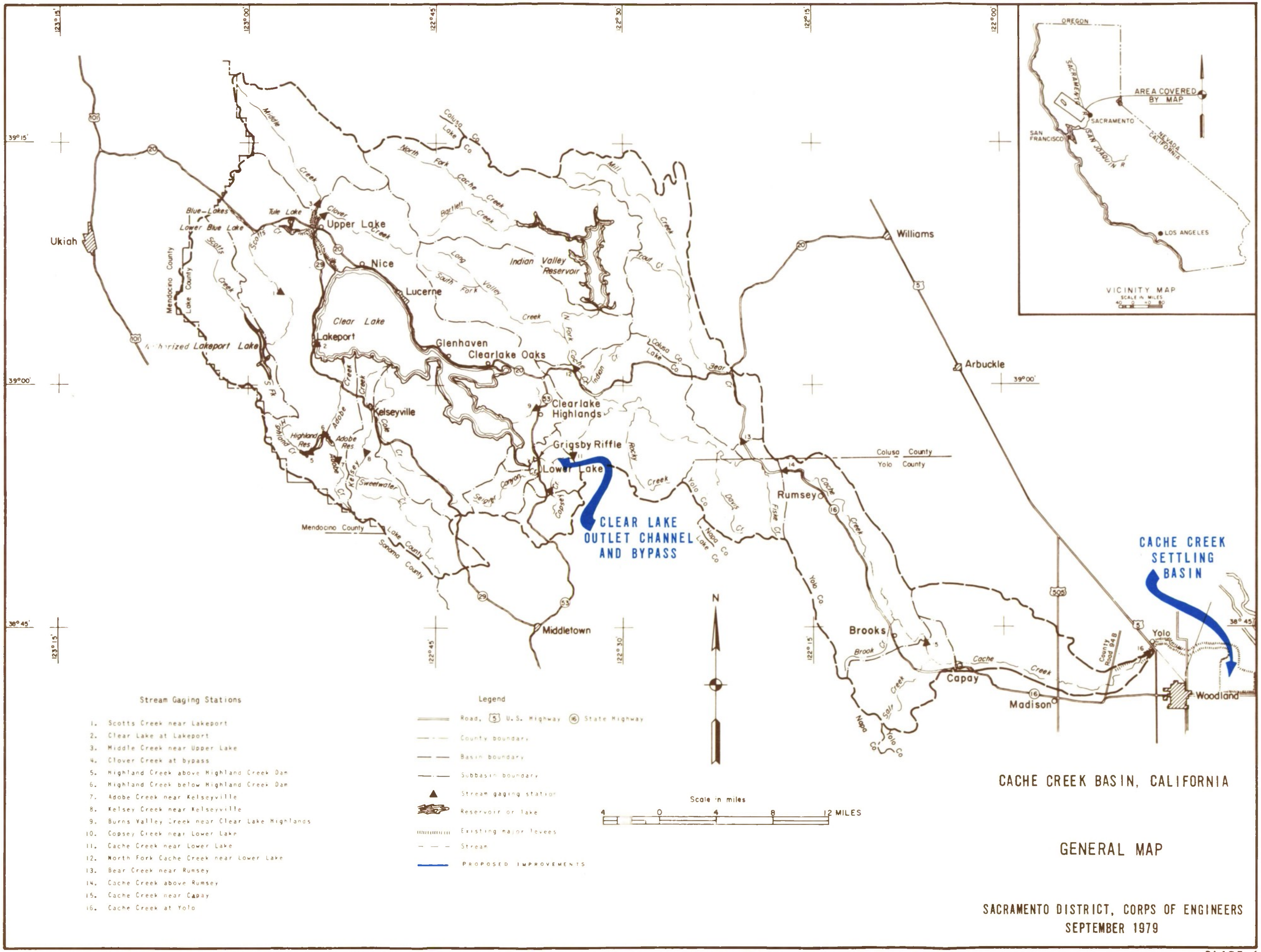
****Has been reduced by 177,000 due to revenue obtained from leasing for agricultural production.

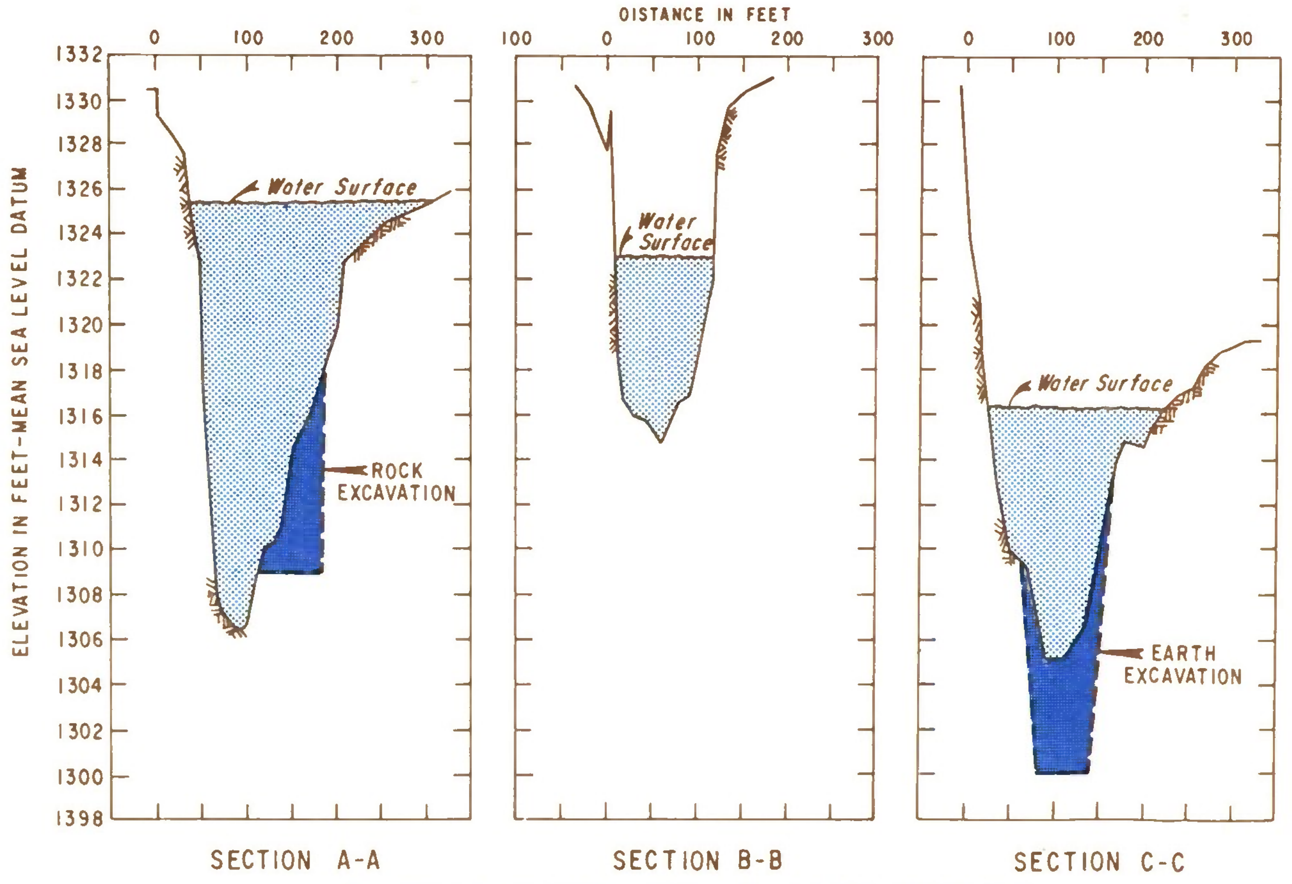
TABLE 4

FEDERAL AND NON-FEDERAL COSTS OF ALTERNATIVES CONSIDERED FURTHER*

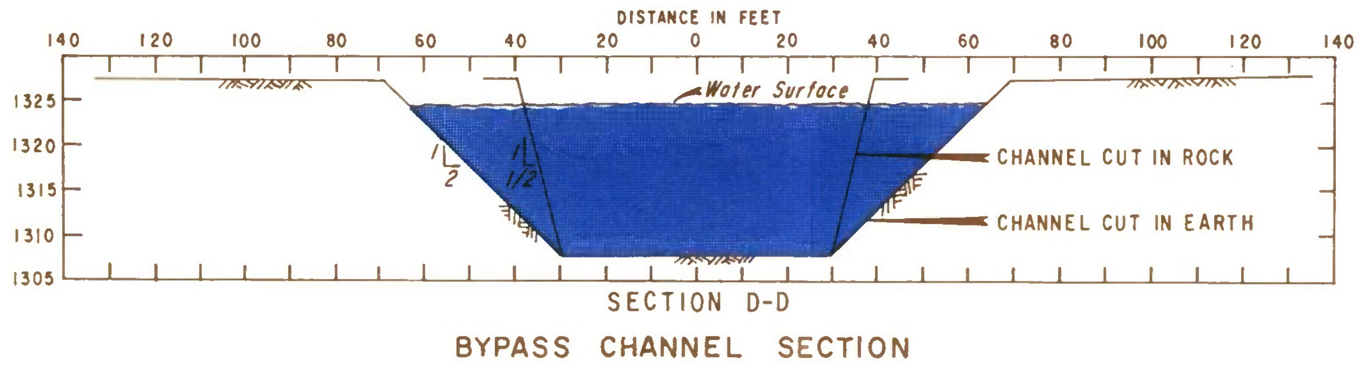
ALTERNATIVE	FIRST COST (Dollars)		
	FEDERAL	NON-FEDERAL	TOTAL
FLOOD CONTROL			
1. Flood proofing future facilities	-	-	-
2. Enlarge Clear Lake outlet channel	5,916,000	2,760,000	8,676,000
3. Enlarge Clear Lake outlet channel and bypass (Selected Plan)	3,740,000	2,310,000	6,050,000
4. Enlarge Clear Lake outlet channel and bypass (NED Plan)	3,565,000	2,310,000	5,875,000
5. Enlarge Clear Lake outlet channel, modified bypass and Anderson Marsh (EQ Plan)	5,019,000	2,305,000	7,324,000
6. No action			
SEDIMENT CONTROL			
1. Raise settling basin levees and establish a wildlife refuge (EQ Plan)	10,402,000	2,280,000	12,682,000
2. Raise levees, establish a refuge and excavate settling basin (NED and Selected Plan)	9,630,000	2,280,000	11,910,000
3. Raise levees and excavate settling basin (with agriculture)	8,220,000	3,130,000	11,350,000
4. No action			

*Cost sharing is based upon traditional requirements and does not reflect the President's recent water policy.


CACHE CREEK BASIN, CALIFORNIA
GENERAL MAP
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1979
CLEAR LAKE OUTLET CHANNEL AND BYPASS
CACHE CREEK SETTLING BASIN
VICINITY MAP
AREA COVERED BY MAP
OREGON
NEVADA
CALIFORNIA
SACRAMENTO
SAN FRANCISCO
LOS ANGELES
SAN JOAQUIN R
SACRAMENTO R
Stream Gaging Stations
1. Scotts Creek near Lakeport
2. Clear Lake at Lakeport
3. Middle Creek near Upper Lake
4. Clover Creek at bypass
5. Highland Creek above Highland Creek Dam
6. Highland Creek below Highland Creek Dam
7. Adobe Creek near Kelseyville
8. Kelsey Creek near Kelseyville
9. Burns Valley Creek near Clear Lake Highlands
10. Copsey Creek near Lower Lake
11. Cache Creek near Lower Lake
12. North Fork Cache Creek near Lower Lake
13. Bear Creek near Rumsey
14. Cache Creek above Rumsey
15. Cache Creek near Capay
16. Cache Creek at Yolo
Legend
Road, U.S. Highway, State Highway
County boundary
Basin boundary
Subbasin boundary
Stream gaging station
Reservoir or lake
Existing major levees
Stream
PROPOSED IMPROVEMENTS
Scale in miles
4 0 4 8 12 MILES
N
Ukiah
Upper Lake
Nice
Lucerne
Clear Lake
Lakeport
Glenhaven
Clearlake Oaks
Clearlake Highlands
Grigsby Riffle
Lower Lake
Kelseyville
Middletown
Williams
Arbuckle
Rumsey
Brooks
Capay
Madison
Yolo
Woodland
Indian Valley Reservoir
Colusa County
Yolo County
Mendocino County
Lake County
Sonoma County
PLATE 1



EXISTING CHANNEL TYPICAL CROSS SECTIONS



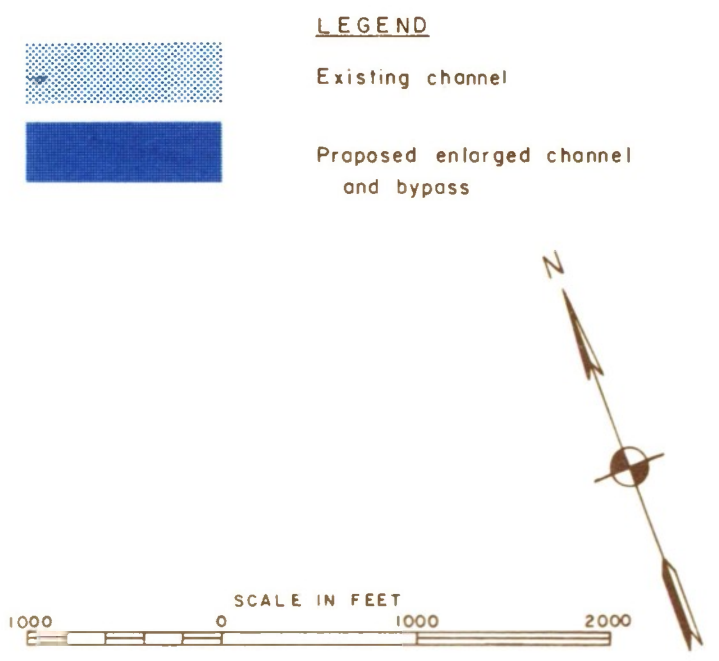
BYPASS CHANNEL SECTION

COURT DECREES AFFECTING CLEAR LAKE OPERATION

1. Gopcevic Decree (1920)
   a. Maximum Clear Lake stage cannot exceed 9.00' on Rumsey Gage, at Lakeport at any time. Stages between 7.56' and 9.00' are permitted for up to 10 successive days for temporary floodwater storage.
   b. Minimum Clear Lake stage set at zero on Rumsey Gage. In determining releases from the lake, irrigation, evaporation, and other losses must be included.
   c. Prohibits any alteration of the outlet channel except that necessary to carry out the provisions of the decree.
2. Bemmerly Decree (1940)
   a. Prohibits any widening, deepening, or enlarging of the Clear Lake Outlet Channel that could increase the flow from Clear Lake into Cache Creek.

PROPOSED CLEAR LAKE FLOOD OPERATION CRITERIA

The outlet channel will be operated so as to reduce stages at Clear Lake as much as possible without causing flows at Rumsey in the range above 20,000 c.f.s. to exceed the flows which would occur under present conditions. This will be accomplished by releasing at the project channel capacity as long as flows at Rumsey are not projected to exceed 20,000 c.f.s. and by controlling releases from Clear Lake to the present outlet capacity for the corresponding stage when flows at Rumsey are projected to exceed 20,000 c.f.s.

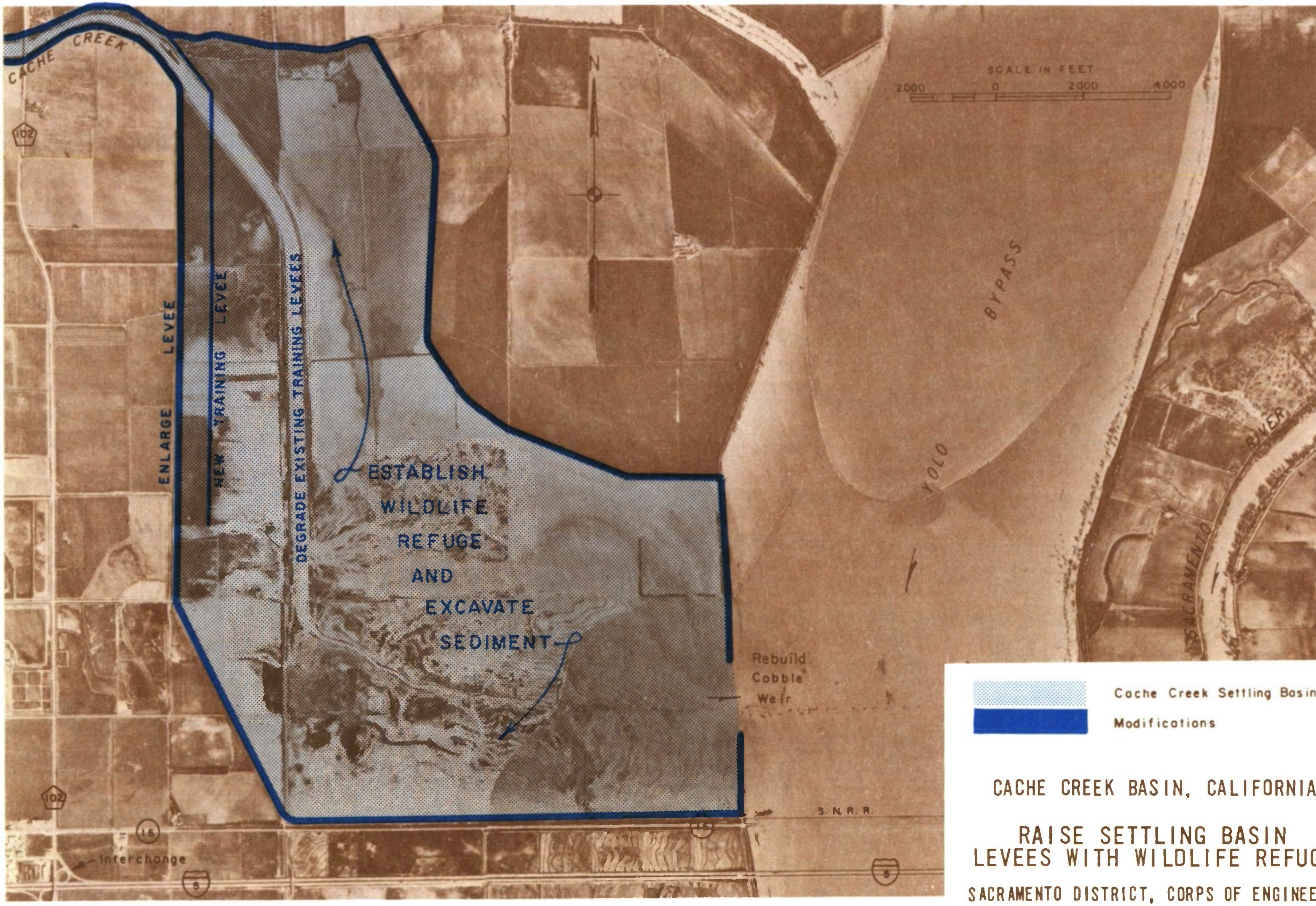


CACHE CREEK BASIN, CALIFORNIA

ENLARGE CLEAR LAKE
OUTLET CHANNEL AND BYPASS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

PLATE 2



CACHE CREEK BASIN, CALIFORNIA

RAISE SETTLING BASIN
LEVEES WITH WILDLIFE REFUGE

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

PLATE 3

FEBRUARY 1979

APPENDIXES

Cache Creek Basin
California

Feasibility Report
And
Environmental Statement
For
WATER
RESOURCES
DEVELOPMENT

CACHE CREEK BASIN, CALIFORNIA

FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT
FOR WATER RESOURCES DEVELOPMENT

LAKE AND YOLO COUNTIES, CALIFORNIA

Technical Report

SECTION A	THE STUDY AND REPORT
SECTION B	RESOURCES AND ECONOMY OF THE STUDY AREA
SECTION C	PROBLEMS AND NEEDS
SECTION D	FORMULATING THE PLANS
SECTION E	THE SELECTED PLANS
SECTION F	ECONOMICS OF THE SELECTED PLANS
SECTION G	DIVISION OF PLAN RESPONSIBILITIES
SECTION H	PROPOSED REVISED COST-SHARING RESPONSIBILITIES

APPENDIX 1

PREPARED BY THE
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

SECTION A

THE STUDY AND REPORT

THE STUDY AND REPORT

TABLE OF CONTENTS

LIST OF PLATES

SECTION A

THE STUDY AND REPORT

1. The organization and content of this technical appendix are explained in this section, which also contains background information concerning the study itself, including authorization, scope, participants and coordination, and prior studies and reports. The technical appendix follows essentially the same sequence as the main report but provides more detailed information developed during the investigation.

Purpose and Authority

2. The purpose of this study was to investigate flood, sediment, and related water resource problems and needs of the Cache Creek Basin and describe the various alternatives considered to solve the problems. Economic feasibility, environmental quality, social compatibility, and conformance with the wishes of local interests were major considerations in selecting a plan of improvement. This report has been prepared as a basis for seeking Federal authorization to participate in constructing a project

to alleviate flood, sediment, and related problems in the Cache Creek Basin and is in response to resolutions by the House of Representatives, as discussed in the following paragraphs:

3. The Committee on Flood Control of the House of Representatives on 29 May 1946 adopted a resolution concerning protection against floods in the Clear Lake area. The resolution reads:

> "Resolved by the Committee on Flood Control of the House of Representatives, that the Board of Engineers for Rivers and Harbors created under Section 3 in the River and Harbors Act approved June 13, 1902, be and is hereby requested to review the report on the Sacramento River and tributaries, California, from Collinsville to Shasta Dam, published in House Document Numbered 649, 78th Congress, 2nd Session, and subsequent reports, with a view of determining whether previously considered plans for the control of floods in the Cache Creek Basin should be modified in any way and particularly with a view to determining the most practicable method of providing protection against floods in the Clear Lake area."

The Committee on Public Works of the House of Representatives on 19 June 1963 adopted a resolution concerning the Cache Creek Settling Basin. The resolution reads:

> "Resolved by the Committee on Public Works of the House of Representatives, United States, That the Board of Engineers for

Rivers and Harbors be, and is hereby, requested to review the reports on Sacramento-San Joaquin Basin Streams, California, published as House Document Numbered 367, Eighty-first Congress, First Session, and other reports, with a view to determining whether the existing project should be modified in any way at the present time, with particular reference to the Cache Creek Settling Basin."

Scope of the Study

4. Cache Creek Basin study area lies on the eastern slope of the Coast Range adjacent to the Eel River, Stony Creek, and Putah Creek Basins. The basin drains 1,150 square miles, including portions of Colusa, Lake, and Yolo Counties, and is naturally divided into two areas: the Clear Lake area, including tributaries to the lake, and the Cache Creek area, comprised of Cache Creek and its tributaries. The study area is shown on plate A-1.

5. The results of the studies presented in this report represent the culmination of investigations conducted by the Corps of Engineers in analyzing flood, sediment, and related water resource problems of the Cache Creek Basin. Several alternatives to help solve these problems were investigated on a preliminary basis. A benefit-cost analysis and an

assessment of environmental, social, and economic effects were completed for each alternative. From these alternatives, the most desirable plans were selected based upon wishes of local interests; environmental, social, and economic acceptability; and cost effectiveness. Detailed studies of these plans were then made which included detailed design and cost estimates; hydrologic studies; analysis of benefits; and assessments of environmental, social, and economic effects. Studies were made in sufficient depth and quality to support the recommendations.

6. To perform the various studies necessary, substantial data were collected. Certain of the mapping and topographic data used in the investigation are as follows:

a. Channel cross sections taken along the Clear Lake Outlet Channel and on Cache Creek from Rumsey downstream to Cache Creek Settling Basin.

b. Topographic surveys made of the Cache Creek Settling Basin in 1934 by the Corps of Engineers and again in 1968, 1971, 1974, and 1975 by the State of California.

c. Topographic surveys made of the Yolo Bypass adjacent to the Cache Creek Settling Basin in 1971 by the State of California.

d. Soil tests made in 1975 of the materials within the Cache Creek Settling Basin to determine their suitability for agricultural and engineering purposes.

e. Extensive topographic surveys with 2-foot contours, available for many of the developed areas around the perimeter of Clear Lake, used to determine the extent of the flood plain.

f. Infrared aerial photos of Clear Lake in 1975 obtained from NASA and used in the environmental studies.

Study Participants and Coordination

7. Study Participants and Their Contributions.

a. State of California Reclamation Board provided technical assistance on sediment control evaluation and provided estimates of cost for real estate, relocations, and easements.

b. Lake County and Yolo County Flood Control and Water Conservation Districts provided assistance on public participation activities and the operational aspects of Clear Lake for flood control.

c. U.S. Fish and Wildlife Service and California Department of Fish and Game provided evaluations on fish and wildlife aspects of the investigation and analysis of fish and wildlife benefits and associated costs.

8. The following organizations and agencies contributed to the study:

LOCAL ORGANIZATIONS AND AGENCIES

Audubon Society, Red Bud Chapter and Davis Chapter

California Wildlife Federation, Inc.

Central California Agency, Bureau of Indian Affairs

Central Valley Regional Water Quality Control Board

Clear Lake Water District

Clear Lake Water Quality Council

County of Yolo Public Works

Lake County Board of Supervisors

Lake County Flood Control and Water Conservation District

Lake County Planning Department

Northern Yolo Conservation and Resources District

Reclamation District 2035

Sierra Club, Mother Lode Chapter and Redwood Chapter

University of California

Yolo County Board of Supervisors

Yolo County Chamber of Commerce

Yolo County Flood Control and Water Conservation District

Yolo County Health Department

Yolo County Planning Department

Yolo County Water Resources Board

Yolo Sportsmen's Association

STATE AGENCIES

Attorney General's Office

California Department of Fish and Game

California Regional Water Quality Control Board

California Reclamation Board

California Department of Water Resources, Central District
and Northern District

Department of Transportation

Division of Forestry

Division of Soil Conservation

Division of State Lands

Farm Bureau Federation

Historic Preservation Office

FEDERAL AGENCIES

Bureau of Land Management

Bureau of Indian Affairs

Bureau of Outdoor Recreation

Bureau of Reclamation

Environmental Protection Agency

Federal Highway Administration

Fish and Wildlife Service

Forest Service

Geological Survey

National Park Service

Soil Conservation Service

Public Meetings

9. In addition to many informal meetings, the following formal public meetings and associated activities concerning the study have been held with Federal, State, and local agencies, news media, and interested organizations and individuals.

a. The Notice of Initiation of Investigation was sent in May 1969 to 240 parties.

b. The first public meeting was held on 2 July 1969 in Woodland and was attended by 62 people.

c. During the plan formulation stage of the investigation, two public meetings were held to present alternative plans. These public meetings were held on 2 and 4 December 1975 and were sponsored by Lake County Flood Control and Water Conservation District and Yolo County Flood Control and Water Conservation District, respectively. The meetings were attended by 117 people.

d. An informal workshop was held on 9 March 1978 in Clear Lake Highlands, and formal public meetings were held 20 and 21 March 1978 to

present the proposed plans of improvement and provide opportunity for public comment. Forty persons attended the workshop and 96 attended the public meetings.

Information Brochure

10. An Information Brochure, "Investigation for Flood Control and Related Purposes, Cache Creek, California," November 1975, was published to present for public evaluation alternative solutions studied for flood control, sediment control, and associated needs in the Cache Creek Basin.

The Report

11. This report is arranged into a main report and four appendixes. The main report, a summary of Appendix 1 (the Technical Report), is meant to be readily understandable to the nontechnical reader. The main report also contains material on plan implementation, coordination, a summary, conclusions, and recommendations.

12. Appendix 1 presents for the technical reviewer more detailed technical aspects of the study and its results. The main report and Appendix 1 generally follow the same format in presenting problems and developing solutions.

13. Appendix 2 contains all comments received as a result of coordination of the draft feasibility report and EIS. Responses to those comments received on the draft EIS are also included in Appendix 2.

14. Appendix 3 contains copies of the Gopcevic Decree of 1920 and the Bemmerly Decree of 1940. These decrees govern the flood control and water supply operation of Clear Lake.

15. Appendix 4 is the Environmental Statement. References are made in the Environmental Statement to other parts of the report where more detailed information can be found. In accordance with guidance from the Council on Environmental Quality (CEQ), the EIS has been limited to a concise analysis and evaluation of the significant impacts of the proposed plan and alternatives to the proposed plan so that the EIS will be more readable and a more useful document to the public and decision makers. Detailed information is contained in Appendix 1 and is referenced where appropriate in the EIS.

16. Appendix 5 is the Section 404 Evaluation Report, which is required by Section 404 of the Clean Water Act of 1977, Public Law 92-500, as amended, when dredged or fill material is placed into water of the United States or associated wetlands. A summary of the evaluation is contained in the environmental statement (Appendix 4).

17. Appendix 6 contains reports of others and correspondence which is pertinent to this report but was not obtained as a direct result of coordination of the draft feasibility report and EIS.

Prior Studies and Reports

Corps of Engineers

18. Senate Document 23, dated 16 December 1925, authorized a settling basin at the mouth of Cache Creek. A history of development is discussed in Appendix 1, Section C. In the mid-1960's the Corps conducted studies of the settling basin, but no action was recommended as a result since the need for sediment control was not critical at that time.

19. House Document No. 259 (89th Congress, 1st Session), dated 9 August 1965, covered an interim report on Scotts Creek, Cache Creek Basin, California, and recommended construction of a multiple-purpose dam and reservoir at the Lakeport site on Scotts Creek for flood control, municipal water supply, irrigation, recreation, fish and wildlife, and downstream levee and channel improvements for flood control. The project was subsequently authorized in the Flood Control Act of 1965. Advance engineering and design studies have been completed; however, the project has not been constructed due to a lack of local assurances. Therefore, the project has recently been classified as deferred pending receipt of these assurances.

20. The Corps of Engineers investigated the Clear Lake - Cache Creek Basin during the latter 1940's to determine methods of solving flooding and water resource problems in the basin. In a "Review Report on Cache Creek Basin California," July 1950, proposed were a 250,000 acre-foot reservoir at the Indian Valley site on North Fork Cache Creek, a 40,000 acre-foot reservoir at the Kelseyville site on Kelsey Creek, channel improvement on Middle and lower Scotts Creeks, a new channel for diverting floodflows of Clover Creek, and enlargement of the Clear Lake Outlet Channel. Other sites, such as the Blue Ridge and Wilson Valley sites on Cache Creek and several small reservoirs on tributaries to Clear Lake, were also studied.

21. The Corps proposed that the Clear Lake Outlet Channel be enlarged to a capacity of 8,000 cfs to allow improved operation of Clear Lake for flood control purposes. All of the proposed reservoirs were to provide flood control and to conserve water, primarily for irrigation. In addition, all of the proposed facilities, but primarily the enlarged Clear Lake Outlet Channel and Indian Valley Reservoir, were to enhance recreation.

U.S. Bureau of Reclamation

22. The Bureau of Reclamation studied plans for developing the water resources of the Clear Lake - Cache Creek Basin as a part of "The Comprehensive Plan for Central Valley Basin California," dated May 1947. The Bureau contemplated that the runoff from Cache Creek, other than that

from Clear Lake, would be regulated in Indian Valley Reservoir on North Fork Cache Creek and Wilson Valley Reservoir on the main stream, utilizing capacities of 250,000 and 210,000 acre-feet, respectively. These reservoirs were to be used primarily for irrigation but were to be operated also for flood control. Irrigation water supply was to be used for lands just west of Woodland. Development was also proposed for Kelsey Creek and the Yolo-Zamora Canal. With the exception of Indian Valley Reservoir, none of these facilities has been constructed.

Soil Conservation Service

23. There are two U.S. Soil Conservation Service watershed projects currently in final feasibility stages of planning in the vicinity of Cache Creek.

a. The Cottonwood - Willow Slough Watershed Project located adjacent to the Cache Creek Basin, south of Capay. The Lamb Valley Diversion feature of this project would divert floodflows into Cache Creek near Capay. The timing of peaks and relatively small flows of this diversion will cause negligible additions to the peak flows on Cache Creek. The major feature of this project is a proposed reservoir on Cottonwood Slough, in the upper portion of the watershed. This feature would reduce the floodflows into Willow Slough.

b. The Dry Slough - Davis Area Watershed Project located adjacent to the south boundary of the Cottonwood - Willow Slough watershed.

Features of this project, which include a diversion of Chickahominy Slough floodflows into Putah Creek, would reduce the floodflows into Willow Slough. The combined features of these two projects would reduce the floodflows into Willow Slough but would have no effect on Cache Creek floodflows.

State of California

24. The Department of Water Resources (DWR) has considered the transmountain diversion of Eel River water. The water thus developed would be integrated into the State Water Project. These studies showed that of a possible 670,000 to 1,230,000 acre-feet diverted from the Eel River, about 60,000 acre-feet is expected to be used in the Cache Creek Basin and the remainder would be exported. The State developed 12 possible diversion schemes, some of which are via Cache Creek Basin. The most promising route includes the Cache Creek Basin. Following completion of the DWR studies, the State established, in December 1972, the California Wild and Scenic Rivers System, of which portions of the Eel River are a part; and further studies were deferred. A report and five appendixes concerning Eel River water were originally scheduled to be published as DWR Bulletin 175. A report was, however, published in December 1972 presenting alternative plans considered.

25. The Department of Water Resources was directed by the Reclamation Board to develop an interim plan for the operation of the Cache Creek Settling Basin. Two reports prepared in 1968 and 1972 by DWR indicate

that the settling basin storage capacity has been nearly depleted. These reports also discuss both short- and long-term solutions to the sediment deposition problem and indicated a need for additional sediment storage capacity.

Lake County

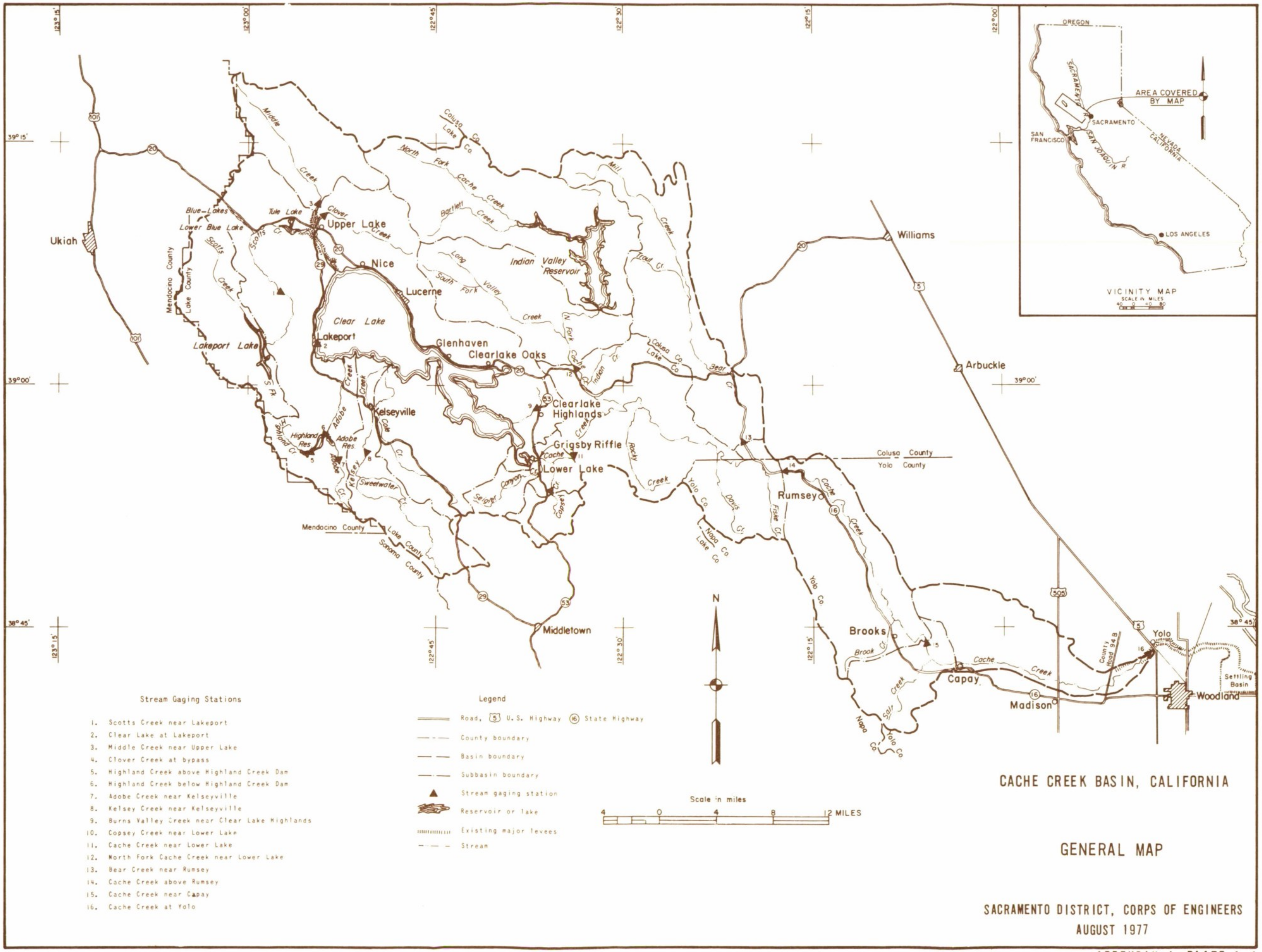
26. Tudor Engineering Company, under contract to Lake County Flood Control and Water Conservation District, prepared two reports in January and November 1973 concerning the Kelsey Creek Water Supply Project. This project would essentially consist of construction of the Pomo Reservoir (Kelseyville Reservoir) on Kelsey Creek to provide for irrigation, domestic water supply, and recreation. The reports have been prepared in compliance with the requirements for a Small Reclamation Project (P.L. 984) Federal loan administered by the U.S. Bureau of Reclamation. The project has since been placed on a priority list by the Bureau.

27. The Development and Resources Corporation prepared a report entitled "Lake County Resource Management Plan," for the Lake County Flood Control and Water Conservation District. This report addressed the water supply needs of Lake County.

Yolo County

28. Reports were prepared for the Yolo County Flood Control and Water Conservation District to meet the requirements for a Small Reclamation Project (P.L. 984) Federal loan for construction of the Indian Valley

Reservoir. Construction of the reservoir was subsequently completed in 1975 and is operated for flood control in accordance with the October 1977 Report on Reservoir Regulation for Flood Control by the Sacramento District, Corps of Engineers.



CACHE CREEK BASIN, CALIFORNIA

GENERAL MAP

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

SECTION B

RESOURCES AND ECONOMY OF THE STUDY AREA

RESOURCES AND ECONOMY OF THE STUDY AREA

TABLE OF CONTENTS

LIST OF TABLES

SECTION B

RESOURCES AND ECONOMY OF THE STUDY AREA

1. The purpose of this section is to provide basic information concerning environmental, natural, and human resources in the general study area so that subsequent discussions of problems and needs and of alternative solutions and their effects will be clear and understandable.

Environmental Setting and Natural Resources

General Basin Description

2. The Cache Creek Basin lies on the eastern slope of the Coast Range adjacent to the Eel River, Stony Creek, and Putah Creek Basins. The basin drains 1,150 square miles which primarily includes portions of Colusa, Lake, and Yolo Counties. The basin is naturally divided into two areas: the Clear Lake area (Lake County), including tributaries to

the lake, and the Cache Creek area comprised of Cache Creek (Yolo County) and its tributaries. Clear Lake is a shallow natural lake having a capacity of about 315,000 acre-feet at an elevation of 1318.65 USGS (at 0 foot Rumsey gage at Lakeport) situated approximately 110 miles north of San Francisco and 110 miles northwest of Sacramento. The lake covers an area of 63 square miles, drains approximately 465 square miles in addition to its own surface area, has a shoreline of some 100 miles, a maximum depth of about 60 feet, and average winter and summer temperatures of 40 and 76 degrees Fahrenheit, respectively. Its principal tributaries are Scotts, Middle, and Clover Creeks entering from the north, and Kelsey and Adobe Creeks entering from the south. Table B-1 presents data relative to these tributaries, and plate A-1, a general map, shows the basin.

3. Clear Lake discharges by way of the 5-mile-long Clear Lake Outlet Channel, including the Grigsby Riffle, a natural geological obstruction, and then through the Clear Lake Dam into Cache Creek. Below Clear Lake Dam, Cache Creek descends through the rugged, 30-mile-long Cache Creek Canyon. The two major tributaries of Cache Creek, the North Fork Cache Creek and Bear Creek, enter the main stream 9 and 24 miles, respectively, downstream of the dam. Cache Creek emerges from the canyon into Capay Valley and meanders through the productive agricultural lands of Yolo County into the Yolo Bypass. Prior to discharging into the Yolo Bypass, a portion of Cache Creek's heavy sediment load deposits in the Cache Creek Settling Basin at the mouth of the creek.

TABLE B-1

Basin Physical Data

	Scotts Creek	Middle Creek	Clover Creek	Kelsey Creek	Adobe Creek (b)	Entire Clear Lake Basin	North Fork Cache Creek	Bear Creek
1.) Drainage Area, Square Miles	107	54	27	48	29	520	225	102
2.) Main Channel Length, Miles	27-1/2	14-1/2	8	21	13	-	34	25-1/2
3.) Maximum Basin Width-Length, Miles	10-17	6-11	4.5-10	8-13	6-10	16-40	15-25	6-24
4.) Maximum-Minimum Elevation, Ft. Above M.S.L.	3950-1326	4700-1326	4200-1326	4720-1326	3040-1326	4700-1326	3030-950	1560-630
5.) Average Annual Runoff, 1000 Acre-Feet (a)	47.7 (1921-70)	33.2 (1921-70)	8.5 (1921-66)	48.7 (1921-71)	25.4 (1955-70)	253.6 (1921-70)	141.3 (1930-70)	87.6 (1959-70)
6.) Maximum-Minimum Annual Runoff, 1000 Acre-Feet (a)	140.8-4.5 (1921-70)	97.4-17.3 (1963-70)	12.9-3.9 (1961-66)	119-8.0 (1921-71)	17.0-2.9 (1955-70)		422.8-15.1 (1921-70)	89.9-6.7 (1959-70)

(a) At Gaging Station.
(b) Includes Highland Creek.

Topography

4. The topography of the Cache Creek Basin can be broken into three areas -- mountain, foothill, and valley. Elevations range from about 4,000 feet around Clear Lake to about 1,500 feet at the foothills, dropping to 30 feet in the existing settling basin and to 20 feet in the Yolo Bypass. The mountain area includes extensive areas of upland valleys as well as alluvial areas around the lake. Below Clear Lake Dam, Cache Creek descends through a rugged, steep 30-mile-long canyon into the relatively broad Capay Valley, where it flows gently out to the Sacramento River Valley.

Geology

5. The Clear Lake area is underlain by metamorphic, igneous, and sedimentary rocks ranging in age from Jurassic to recent. The highland areas are composed of consolidated sandstone, shale, and serpentinized basic intrusive rocks. The valleys are relatively flat alluviated areas underlain by sands and gravels of the Cache formation, Pleistocene volcanics, and terrace and alluvial deposits. The Lower Cache Creek area below Clear Lake Dam is underlain by folded and sedimentary rocks of Cretaceous and Tertiary age. These older consolidated rocks are overlain by semiconsolidated Tehama and related continental deposits of Plio-Pleistocene age and recent alluvial deposits. There is little residual soil in the mountainous portions of the basin, but the valley area downstream from Rumsey is underlain by stream channel, terrace, and

flood plain deposits. Numerous fault and displacement zones occur in the Cache Creek Basin, but none have shown activity in the last 200 years.

6. Mineral production in the basin has come from mercury, pumice, volcanic cinders, sand and gravel, and stone operations. Extensive sand and gravel operations occur in the Cache Creek Channel between Capay and Yolo, and natural gas deposits occur on the Cache Creek alluvial fan.

Climate

7. The climate of the Cache Creek Basin is the mild two-season Mediterranean type that is typical of California's Central Valley. Temperatures sometimes fall below freezing during the winter months and sometimes exceed 100 degrees Fahrenheit in the warm, dry summer months.

8. The mean annual rainfall varies from about 17 inches per year near the town of Yolo in the Sacramento Valley to about 25 inches around Clear Lake and over 60 inches in the upper elevations of the basin. Approximately 95 percent of the average rainfall occurs from October through April. Snowfall occurs occasionally at the higher elevations in the basin.

Surface Hydrology

9. In the Clear Lake area surface water use is supplied by direct diversion of streamflows, minor storage on a few tributary streams to Clear Lake, and pumping from Clear Lake.

10. The Yolo County Flood Control and Water Conservation District provides irrigation water to the lower Cache Creek area. Diversions from Cache Creek, including water released from Clear Lake as well as unregulated runoff, have averaged 100,000 acre-feet annually during the last 30 years. Total annual farm deliveries from Cache Creek diversion have ranged from as low as 13,000 acre-feet in 1924 to as high as 189,000 acre-feet per year.

Ground Water

11. In the Clear Lake area, ground water bodies of significant extent underlie Big Valley southeast of Lakeport, Scotts Valley west of Lakeport, and the Upper Lake area. The underground hydrology of these and other areas was studied in detail by the State Department of Water Resources and the United States Bureau of Reclamation. The Bureau studies indicate that the annual safe yield for the Clear Lake area is 25,100 acre-feet. Ground water recharge occurs from deep percolation of precipitation, streamflow, surface and subsurface inflow from adjacent hills, and from the applied irrigation water.

12. The lower Cache Creek area includes the Capay and the Yolo ground water basins. The ground water reservoir is composed of continental sediments which dip and thicken eastward except where folded in the anticlinal Plainfield Ridge. Most large capacity wells in the area produce from both Tehama Formation and older alluvium. Ground water in the area ranges from unconfined to semiconfined with confinement increasing with depth.

Vegetation General

13. The plant communities identified in the project area are oak-woodland, chaparral, grassland, riparian, freshwater, and marsh. A list of dominant species in each community is available in the Sacramento District.

14. The oak-woodland plant community is represented by valley oak, live oak, digger pine, and California buckeye. This plant community usually occurs on valley floors and foothills from 400 to 3,000 feet in elevation. This community contains both the oak parklands of the valley floors and the digger pine woodland of the surrounding foothills.

15. The chaparral plant community is typified by broad-leafed vegetation 3 to 10 feet high which is often impenetrable and highly flammable. Scrub oak, toyon, ceanothus, and manzanita are some of the indicator species of the chaparral plant community.

16. The grassland plant community is characterized by annual grass species of *Bromus*, *Festuca*, and *Avena*. Many species of spring flowering annual forbs also occur.

17. The riparian plant community is characterized by dense growths of sandbar willow, red willow, cottonwood, elderberry, wild grape, and sycamore along the streambanks.

18. The freshwater marsh community is characterized by dense masses of cattails and bulrushes interspersed with areas of open water.

Vegetation - Clear Lake Outlet Channel

19. The most important botanical feature of this area is Anderson Marsh, located in the shallow water bordering portions of the Cache Creek-Clear Lake Outlet Channel. It is part of the only undeveloped shoreline remaining around Clear Lake and covers some 560 acres. This shallow water marsh is bordered by dense masses of cattails and bulrushes with areas of open water. Surrounding the marsh and closely associated with Cache Creek can be found areas of dense riparian growth. The larger vegetative species are sandbar willow, red willow, cottonwood, elderberry, wild grape, and sycamore. Residential development occurs on the north side of the creek from Clear Lake to approximately 1-1/2 miles east of the Highway 53 Bridge. Development on the south side of the creek extends from the Highway 53 Bridge downstream (east) for 1 mile. The chaparral, oak-woodland, and grassland vegetative cover types occur on the slopes above Cache Creek. In general, the chaparral is confined to the south shoreline of the creek. The north shoreline contains stands of valley and live oak and open grasslands. The lower 0.75 mile of the outlet channel is bordered by dense stands of cattails and bulrushes which provide a freshwater marsh setting.

Vegetation - Lower Cache Creek

20. With the exception of lands immediately adjacent to the creek, lower Cache Creek is surrounded by agricultural lands which support primarily irrigated crops. The canals and drainage ditches entering the creek support cattails, bulrushes, and willows, as well as a number of grass species.

21. Cache Creek in the lower reaches is dry much of the year but supports riparian vegetation in the form of willow, elderberry, cottonwood, blackberry, and tamarisk. The riparian vegetation is limited by agriculture and by the wandering nature of the creek channel which continually cuts into the banks and does not allow extensive vegetative growth to become established. Downstream from the town of Yolo, levees confine the creek within defined banks where riparian vegetation has become established. Wild rose, tamarisk, sandbar willow, elderberry, wild grape, and cottonwood are found on and between these levees. Approximately 90 percent of the Cache Creek Settling Basin (3,600 $\pm$ acres) is under cultivation. The remaining 10 percent contains, almost exclusively, sandbar willow, one of the few vegetative species able to maintain a foothold in the shifting sediments of the basin.

Fish and Wildlife

22. Warmwater fish are the principal species found in the study area. In the Clear Lake Outlet Channel area, Cache Creek is considered by the

State of California to be a Class II - very good waterway and Clear Lake a Class I - premium waterway for warmwater fisheries. Surveys conducted by the California Department of Fish and Game identified 28 fish species occurring in the lake. Since the 1940's, a general decline has been noted in many of the native minnows, i.e., western roach, fat head minnow, riffle sculpin, and three-spined stickleback. Nongame fish such as blackfish, carp, and hitch comprise the bulk of the fish population in Clear Lake. Anderson Marsh provides an important feeding and spawning area for some species of fish and is an important recreational fishing area. When winds inhibit angling at Clear Lake, the outlet channel and Anderson Marsh provide a calm area for anglers. A California Department of Fish and Game creel survey of Anderson Marsh found the brown bullhead composed 97 percent of the fish caught by fishermen, with green sunfish, bluegill, crappie, and carp comprising the remaining 3 percent. An electro-fishing survey conducted in the Anderson Marsh during the same period as the creel survey found nine species of fish in the marsh. Carp, goldfish, and brown bullhead accounted for 92.5 percent of the fish caught, while bluegill, largemouth bass, white catfish, black crappie, Sacramento hitch, and Sacramento blackfish comprised the balance.

23. In the lower Cache Creek area, the reach of Cache Creek located downstream of the town of Capay is principally an intermittent stream that is dry during most of the summer. Flows occur during the late fall, winter, and spring months when rainfall is high and agricultural

water diversions are low or absent. This flow pattern precludes the occurrence of much fish life in Cache Creek below Capay. Some fish may occur in isolated pools and irrigation laterals throughout the year downstream from Capay. A list is available in the Sacramento District of fish species which might be expected to occur downstream of Clear Lake Dam.

24. Wildlife species are described separately for the two subbasin areas. In the Clear Lake Outlet Channel area, Cache Creek from Anderson Marsh to Clear Lake Dam supports a diverse and varied array of wildlife. This is particularly true of the Anderson Marsh area. Mammals commonly found in this area are blacktailed deer, muskrat, raccoon, fox, and grey squirrel. Commonly observed birds include western grebe, blackbirds, herons, egrets, bitterns, valley quail, and mourning dove. Various species of reptiles and amphibians are also present. Lists are available in the Sacramento District of bird species and reptile, amphibian, and mammal species occurring in the area.

25. In the lower Cache Creek area wildlife species are, for the most part, those associated with irrigated agricultural land and riparian habitat. Blacktail jackrabbits and ground squirrels are common mammals. Pheasants, valley quail, mourning dove, and numerous species of waterfowl and songbirds are frequently observed. Lists of bird species and of reptile, amphibian, and mammal species occurring in the area are available in the Sacramento District.

Rare and Endangered Species

26. Table B-2 identifies those wildlife species whose distributions include the Clear Lake and Cache Creek areas and which are found on the Federal and State rare and endangered species lists. The Southern bald eagle, American peregrine falcon, and California yellow-billed cuckoo are wildlife species whose distributions include the Clear Lake and Cache Creek areas and which are found on the Federal and State rare and endangered species lists; however, it should be noted that inclusion of species on these lists does not positively indicate their presence at this time within the project area but rather acknowledges their possible presence based upon the distributional characteristics of each species.

27. The Southern bald eagle and American peregrine falcon may be found associated with the grassland and riparian habitats of the project area, occurring only as casual visitors. The California yellow-billed cuckoo, which nests in dense riparian habitat in California from May until September and winters in South America, has been observed in the riparian areas associated with Cache Creek and Clear Lake.

28. Table B-3 identifies those plant species whose distributions include the outlet channel, Cache Creek, and settling basin areas and which are found on the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California. Table B-3 also identifies the Native Plant Society's inventoried natural areas

TABLE B-2

Rare and Endangered Wildlife Whose Distributions Include the Clear Lake and Cache Creek Areas

Common Name	Scientific Name	Status	Distribution
Southern bald eagle	*Haliaeetus leucocephalus l.*	E[1, 2]	Ranges over most of California, nests in coastal and interior mountains
American peregrine falcon	*Falco peregrinus anatum*	E[1, 2]	Breeding populations in California reported in mountain areas, along the coast and on the Channel Islands
California yellow-billed cuckoo	*Coccyzus americanus occidentalis*	R[1]	Historically nested along stream courses from Shasta County to southern California, present numbers and distribution unknown

E Endangered
R Rare
1 California Department of Fish and Game, 1976.
2 U.S. Fish and Wildlife Service, 1976.

TABLE B-3

Rare and Endangered Plant Species and Natural Areas Whose Distributions Include the Clear Lake and Cache Creek Areas

Rare and Endangered Species

Common Name	Scientific Name
Palmate-bracted birds-beak	Cordylanthus palmatus
Brandegee eriastrum	Eriastrum brandegeae
Burke's baeria	Lasthenia burkei
Few-flowered navarretia	Navarretia pauciflora
Lake County stonecrop	Parvisedum leiocarpum

Natural Areas

Woodland Sugar Ponds
Cache Creek Tule Elk Range*
Anderson Marsh*
Borax Lake and Marsh
Berryessa Peak - Cottonwood Canyon
Cache Creek Flysch Beds*
Cache Creek Valley Oaks
Willow Slough
Wilson Valley*
Manning Flat

*Cache Creek flows through

occurring in this vicinity. The proposed project does not appear to affect the identified ranges of any very rare or rare and endangered species; however, Cache Creek flows through four of the natural areas.

Water Quality

29. Clear Lake has a water quality problem caused by excessive algal growth. This problem results from the eutrophication of the lake caused by a high nutrient (phosphorus and nitrogen) content which encourages massive algal blooms during the spring and summer. This eutrophication of the lake interferes with recreation but does not interfere with agricultural irrigation. Both phosphorus and nitrogen enter the lake with sediment particles from streamflows and surface runoff.

30. The water quality of lower Cache Creek is considered satisfactory for use as agricultural irrigation water. Use of the water is restricted, however, to those crops which are not sensitive to boron. Bear Creek, a tributary to Cache Creek, contributes a high boron content to lower Cache Creek waters. Additional information can be found in Section C of this appendix.

Air Quality

31. Cache Creek Basin is situated in two air basins - Lake County and the Sacramento Valley. Since the majority of the area is lightly industrialized, local emissions are mainly from automobiles. However, most of the directly emitted particulate matter is the result of stationary

sources, primarily agriculture. The highest photochemical oxidants and the highest suspended particulate concentrations occur between July and September. The Sacramento Air Basin has been designated by the Environmental Protection Agency as a nonattainment area for oxidants. These high concentrations are the result of a meteorological phenomena - the semipermanent high pressure system which occupies the eastern Pacific during the summer, effectively blocking storm systems and permitting formation of a daily atmospheric inversion layer. Little data are available on the ambient air quality of the Lake County Air Basin. Air quality of the Sacramento Valley Air Basin at Sacramento during the summer of 1975 is summarized on the following table B-4.

Archeological Values

32. Archeological investigations have established Clear Lake as the site of human life at least 8,000 to 10,000 years ago. Before the coming of the white man, Lake County was inhabited by about 5,000 Indians, making it one of the most densely populated areas in the State. Because of its climate and bountiful resources, the area around Clear Lake provided the Indians one of the finest environments in the State.

33. As a general classification, the Indians are of the Pomo language family, related to members of the Hoken language family. The Pomos lived in three principal belts: the coast, the Russian River Valley, and the lake district.

TABLE B-4

Summary of July, August and September 1975
Air Quality for the Sacramento Air Basin*

Location	Month	Pollutant	Average	Number of Days Standards Exceeded	
				State	Federal
Sacramento	July	Oxidant	.07	5	10
		Carbon Monoxide	2	0	0
		Nitrogen Dioxide	.04	0	-
		Suspended Particulates	57.0	0	0
Sacramento	August	Oxidant	.07	4	6
		Carbon Monoxide	2	0	0
		Nitrogen Dioxide	.04		-
		Suspended Particulates	50.0	0	0
Sacramento	September	Oxidant	.08	4	12
		Carbon Monoxide	3	0	0
		Nitrogen Dioxide	.07	0	0
		Suspended Particulates	85.6	1	0

*California Air Resources Board, 1975 California Air Quality Data, July, August and September 1975, Volume VII No. 3.

34. On the upper and main bodies of the lake, the principal Indian communities were not so much near the shore as near the streams, within easy reach of the lake. Only in Lower Lake, where the surrounding hills were arid or excessively mineralized, was there a true lake population.

35. The Lake Miwok, who are of the Penutian language family, held the drainage areas of several small streams flowing into the very lowest mile or two of Clear Lake, the southern bank of Cache Creek, and the lake outlet for a short distance beyond. They occupied several settlements where Lower Lake now stands.

36. The Indians along Cache Creek and in the remainder of the lower basin were known as Patwin, a segment of the Wintun family which occupied most of the western Sacramento Valley.

37. Archeological surveys in the Clear Lake-Cache Creek Basin have revealed a high density of cultural sites. Some of these appear to have been occupied several thousand years ago. A Patwin site 6 miles northwest of Clear Lake Oaks is on the National Register of Historic Places. None of the 10 sites near the Clear Lake Outlet Channel have been excavated, but the Department of Anthropology, University of California, Davis, conducted limited test excavations in the foothills of Capay Valley. Three of the sites are set back from the creek. Test excavations in one large village on the right bank of Cache Creek have provided the oldest evidence of human occupation in that region of the

foothills. Only very preliminary work has been done in the settling basin area because of the long-term use of the area for sediment deposition.

Historical Values

38. From 1850 to 1855 white settlers entering the Clear Lake area displaced and disrupted much of Lake County's Indian population. In a short time, large portions of the valley were privately owned, agriculture flourished, and mining and lumbering increased significantly. Resort business also began around the numerous mineral springs. In 1861, Lake County was officially organized from a portion of Napa and Mendocino Counties, and Lakeport was made the county seat.

39. Yolo was one of the original 27 counties created in 1850. Cache Creek, which is rich in historical lore, played a crucial role in settling and developing the region. Fur trapping was one of the earliest activities of white men, and French Camp, 1 mile east of Yolo on the north side of Cache Creek, was the campsite of Hudson Bay trappers. In 1829 the first fur brigade in the Sacramento Valley camped here. The name Cache Creek came from the fact that trappers "cached" their fur along the stream. The earliest permanent settlements were also established along Cache Creek. The town of Yolo, originally called Cacheville, began on the north bank of Cache Creek and became the first county seat in 1857. Although the county was not in the gold mining area, it shared in its prosperity because several of the towns were

located favorably as supply centers for the miners. However, from its inception to the present, the dominant factor in the history and expansion of Yolo County has been its rich agricultural resources.

Human Resources

Population Characteristics

40. Lake County, with a total 1976 population of 27,600, ranks 41st in county population in the State. From 1940 to 1970, the population increased at about 3 percent, on the average, annually. The State average for the same period was 3.6 percent annually. The current rate of growth in Lake County is about 5.7 percent annually with the major increase from retirees aged 65 years or older. Historical populations and densities for Lake Lake County are summarized below:

Year	Resident Population	Density In Persons Per Square Mile
1930	7,166	5.4
1940	8,069	6.1
1950	11,481	8.7
1960	13,786	10.4
1970	19,548	14.7
1975	25,700 1/	19.4

Source: U.S. Department of Commerce, Bureau of the Census.
1/ California Statistical Abstract, 1976.

41. The number of seasonal visitors exceeds the number of permanent residents during the Memorial Day to Labor Day vacation period. The local Chamber of Commerce estimates an increase of 80,000 persons during June through August, based on Chamber records and reports of resorts, motels, and restaurants.

42. There are no large urban developments in Lake County. However, most of the urbanized areas are located around Clear Lake rim, and two-thirds of the county population live in these urban centers. Lakeport, the county seat, has the largest population with 3,760, while Clear Lake Highlands-Clear Lake Park has the heaviest population concentration with 5,800 permanent residents.

Year	Average Annual Change	Average Annual Natural Increase	Average Annual Net Migration	Migration as % of Population Change
1950 - 1960	+230	+25	+205	89.1
1960 - 1970	+580	-70	+650	112.1

Source: California State Department of Finance.

43. The birth rate in Lake County is lower than the average statewide birth rate. The percentage of young adults in the population is also lower than the State average. The latter phenomena are common among rural counties, where limited employment and educational opportunities encourage out-migration of young adults to metropolitan areas. Lake County is ranked first in California in percentage of population over 65 and sixth in the United States in county rankings. The median age in the county is 47.0 years.

44. The racial-ethnic distribution of Lake County in 1970 is presented in in the following tabulation.

Racial-Ethnic Distribution - 1970

	White	Black	Spanish Language or Surname	Other
Lake County	92.4%	0.2%	4.5%	2.9%

Source: Derived from 1970 Census of Population and Housing.

45. The population of Lake County is comprised predominantly of whites, with 92.4 percent, compared with 74.0 percent for the State. The next largest racial or ethnic group is composed of residents with a Spanish heritage, representing 4.5 percent of the county population, compared with 15.5 percent for the State. Approximately 0.2 percent of Lake County's population is black, which is significantly less than 7 percent that is representative for California.

46. Yolo County had an estimated 1976 population of 104,700 and ranked 28th in the state. Much of the recent population growth has been the result of net inmigration and has centered in the incorporated areas of Woodland and Davis. Woodland, with an estimated population of 25,150 in 1974, is the only major population center partly in the basin. The following tabulation shows historical population growth for Yolo County.

Year	Resident Population	Density in Persons Per Square Mile
1930	23,644	22.8
1940	27,243	26.3
1950	40,640	39.3
1960	64,727	62.6
1970	91,788	88.8
1975	101,600 1/	98.3

Source: U.S. Dept. of Commerce, Bureau of Census.
1/ California Statistical Abstract, 1976.

The following tabulation describes population change by source.

Year	Average Annual Change	Average Annual Natural Increase	Average Annual Net Migration	Migration as % of Population Change
1950-1960	+2,509	+876	+1,633	65.1
1960-1970	+2,606	+1,008	+1,598	61.3

Source: Central Valley Report 1973.

47. The county birth rate is now below 2.1 children per family. The median age in the county is 24.5, compared with 28.1 for the State.

48. As shown below, nearly 78 percent of the population of Yolo County is white, while for the State it is 74 percent. Those persons with a Spanish heritage account for 16.7 percent of the county's population, compared with 15.5 percent for California. About 1.2 percent of the county population is black, while 7 percent is representative for the State.

Racial-Ethnic Distribution - 1970

	White	Black	Spanish Language or Surname	Other
Yolo County	77.9%	1.2%	16.7%	4.2%

Source: Derived from 1970 Census of Population and Housing.

Education

As the following tabulation shows, educational levels differ for people in the upper and lower subbasins:

	% of Males 25 Yrs. or Older H.S. Graduates	% of Females 25 Yrs. or Older H.S. Graduates	% of Total 25 Yrs. or Older College Graduates
Lake County	48.2	52.5	1
Yolo County	60.7	62.5	18

Source: 1970 Census of Population, General, Social and Economic Characteristics.

49. One of the most serious problems in Lake County resulting from relatively low educational levels, particularly regarding high school dropout rate, is the lack of a skilled labor force. It should be noted that part of the extreme variation between the two counties in number of college graduates is that the University of California is located at Davis in Yolo County.

50. Education statistics for primary and secondary systems in both counties are shown in table B-5.

TABLE B-5

Educational Statistics
Fall 1971 to Fall 1972

School District	Elementary Enrollment	Secondary Enrollment	% Increase or Decrease	Median School Yrs. Completed	No. Teachers	Teacher-Pupil Ratio	Avg. Ann. Teacher Salary	Avg. Ann. Expenditure Per Student
Yolo County:								
Esparto Unified	608	224			40	1:21	$ 9,870	$924
Woodland Unified	5,003	2,812			329	1:24	$11,746	$920
Countywide	13,662	5,403	- .5%	12.4	889	1:21	$10,727	Unknown
Lake County	2,941	1,434	+3%	11.9	215	1:17	$10,532	$200
State Averages				12.3		1:28	$11,431	$937

51. There is no official use of Clear Lake by local schools in Lake County. Limited water quality experimentation is periodically carried out, but not as part of the formal curriculum. Portions of Cache Creek are widely used for study by local schools and youth organizations. A field trip guide for elementary school teachers identifies five sites along or within the creek which have special merit as "natural laboratories." The sites are on private land, and access ranges from "unrestricted" to "access subject to owner's permission."

Housing

52. Over 55 percent of the total housing units in Lake County are summer homes or cabins. A study by the Lake County Coordinating Council for Overall Economic Development indicates that of a net increase in housing from 1961-1970 of 2,279 units, one-half were second homes not used for permanent housing. Subdivisions created primarily for seasonal homes have existed for many years in the Clear Lake area. However, growth of both recreational and residential subdivisions has slowed in recent years. The following data are taken from the 1970 Census of Housing:

Total Owner Occupied	Total Renter Occupied	For Rent	For Sale	Other Year Around	Vacant Seasonal Migratory	Total Dwelling Unit Inventory
5,638	2,041	233	176	3,748	325	12,161

53. There are approximately 4,000 trailer and mobile homes, and mobile home development leads all new forms of housing. Housing type is distributed as follows:

Singles	Multiples	Mobile Homes 1/	Vacant Seasonal Migratory	Total Dwelling Unit Inventory
9,905	587	1,344	325	12,161

1/ The low number indicated excludes mobile homes and trailers if vacant or used only for business or vacation purposes.
Source: Detailed Housing Characteristics, California, 1970.

54. Quality, condition, and prices of houses in Lake County vary from low to high. Because there are no zoning restrictions, lower quality homes are interspersed with expensive, higher quality homes, mobile homes, and semipermanent and vacation trailers. This is particularly evident along Clear Lake rim and the Clear Lake Outlet Channel.

55. In Clear Lake Basin, 10 percent of the dwellings are substandard. In 1970 about 5 percent of the dwellings in urbanized areas were identified as substandard. The estimated population living in substandard housing was 1,172. The median number of persons per all occupied units is low at 2.1, which indicates that overcrowding is not one of the critical factors in the problem of substandard housing. Substandard housing is scattered throughout the county but is more concentrated in portions of the towns of Clear Lake Highlands, Clear Lake Oaks, and to a lesser extent Lucerne and Lakeport. Many of the

older resorts have been converted into apartments for elderly and retired persons on low, fixed incomes and often are not repaired or maintained. Substandard housing is randomly distributed along Clear Lake Outlet Channel.

56. About 62 percent of the homes in Lake County were built prior to 1960, according to the 1970 census. The following tabulation summarizes the distribution of Lake County housing by year of construction.

Year Structure Built	Prior to 1940	1940-1949	1950-1959	1960-March 1970
Percent of Total Structures	20.3	16.0	26.4	37.3

Source: 1970 Census of Housing.

57. Rentals and real estate prices are similar throughout the county, except that prices in the City of Lakeport are about 5 percent higher than prices in the other unincorporated towns in the county. The median price of a home for sale in 1970 was $13,400. The costs of new homes have increased drastically, as they have in the rest of the state.

58. The overriding housing problem in this portion of the basin is the gap between new housing constructed and population increases. Available housing has increased at an average rate of 2 percent per year, considerably less than the population growth rate. Although many second homes have been built, these have not replaced substandard housing, and the high cost of new housing eliminates much of the low income

population from the housing market. Furthermore, private investers have shown no interest in constructing housing for low and moderate income families.

59. The following is a count of dwellings in Yolo County as of 1 April 1970.

Total Owner Occupied	Total Renter Occupied	For Rent	For Sale	Other Year Around	Vacant Seasonal Migratory	Total Dwellings Inventory
15,936	12,936	709	170	411	127	29,728

Source: Detailed Housing Characteristics, California, 1970.

The predominant housing type is single-family residential, as shown below:

Singles	Multiples	Mobile Homes	Vacant Seasonal Migratory	Total Dwelling Unit Inventory
20,629	7,506	1,466	127	29,728

Source: Detailed Housing Characteristics, California, 1970.

60. Multiple units, as percentage of the total housing stock, are increasing. Within the lower part of the basin, housing is concentrated mainly in Woodland, where prices for houses are typically higher than the median price of $25,600 in the overall lower basin. There are marked differences in the quality and adequacy of housing throughout the

lower basin. With the exception of Woodland, communities within the lower basin exceed the countywide average for percentages of substandard housing; 382 houses, or about 53 percent of the total housing stock, are estimated to be substandard within designated townsites in the lower basin.

61. As with Lake County, a majority of Yolo County housing units, or about 60 percent, were constructed before 1960. The following tabulation summarizes the 1970 distribution of housing units in Yolo County by year of construction.

Year structure built	Prior to 1940	1940-1949	1950-1959	1959-March 1970
Percent of Total Structures	18.8	11.3	30.3	39.6

Development and Economy

Land Use

62. Less than 45 percent of the land in Lake County is privately owned. The remainder is held by the Federal Government, chiefly within the Mendocino National Forest; by the State, which has developed only a small portion of its holdings; and by local governments.

63. The upland areas are steep and generally unsuitable for development or agriculture because of poor soils and lack of water. Mining and lumbering in the upland areas have decreased substantially.

64. Irrigated agriculture and urban development, which comprise less than 10 percent of the land use, are generally concentrated in the areas near Clear Lake. Urban development is concentrated along approximately 100 miles of lake shoreline. About 39 miles of this is developed for water-associated recreation and permanent or summer homes.

65. Along the Clear Lake Outlet Channel, scattered residential and resort development occurs on the north side of the creek from Clear Lake to approximately one-half mile east of the Highway 53 bridge. Two residential pockets are found on the south side of the channel, one extending from the Highway 53 bridge downstream for approximately one-half mile and the other located approximately three-fourths of a mile downstream of this first development. Marshland and pastureland constitute the remaining land uses along the outlet channel.

66. Other than the relatively fertile lands along the tributaries in Long Valley, Indian Valley, and Bear Valley, the land downstream of Clear Lake and upstream of Capay Valley is generally mountainous and unproductive.

67. Lands downstream of Clear Lake Dam and adjacent to and within Cache Creek channel are primarily privately owned. The Bureau of Land Management controls some 23,000 acres of public land in the mountainous Cache Creek Canyon portion of the basin.

68. In the Capay Valley, lands are primarily agricultural, with a preponderance of orchards. The small rural towns of Rumsey, Guinda, Brooks, and Capay are located along Highway 16, which extends through the Capay Valley. There is growing residential development scattered throughout the foothills of this valley.

69. In the flatlands in the lower portion of the basin, the major portion of irrigable land is intensively cultivated in row crops, field crops, and orchards. Nonirrigated land is used for grain production and grazing. In this section of the basin are the small towns of Esparto and Yolo, and Woodland, the largest city in the Clear Lake-Cache Creek Basin.

70. Gravel extraction is the most significant land use within the creek channel, with nine plants currently operating from the Madison Bridge to Yolo.

71. Of the 3,600 acres within the Cache Creek Settling Basin, approximately 90 percent is used solely for agriculture. The remainder is covered with native vegetation that provides valuable wildlife habitat.

To permit passage of floodflows, the Reclamation Board has purchased flowage easements from landowners within the settling basin.

Property Values

72. Property values in the Clear Lake area depend on demand and local governmental policy. Local government has been reluctant to control land use. Although zoning is currently underway, to date only a small portion of the land has been zoned for specific residential, commercial, or agricultural uses. Therefore, property values are extremely sensitive to the inflationary pressures of speculation and the deflationary dangers of nondirected development.

73. Lake frontage, selling for $250 to $400 a front foot, is the most desirable and highest priced land in the area. Property values around Lakeport and the southern side of the lake are higher than property values in the rest of the basin. Along Clear Lake Outlet Channel, lots sell for about $250 to $300 a front foot.

74. Agricultural land values are comparatively high. Land used for pear orchards is considered prime and ranges from $1,500 to $2,000 per acre. Land for dryfarming sells from $800 to $1,000 per acre. This amount seems high as dryland farming is generally no longer economically feasible in this area. It, therefore, can be assumed that buyers either intend to improve the land for intensive agriculture or develop it for

recreational or residential use. Pastureland sells for about $300 to $500 per acre. Industrial properties range from $350 to $2,500 per acre.

75. Property is generally in great demand in the lower Cache Creek area; consequently, values are relatively high. The exceptions are the small rural towns, where lots are not generally as desirable and supply exceeds demand. Highest property values for all categories of land are found in the Woodland area.

76. There is a high demand for rural-residential sites outside established urban areas, and property values have increased dramatically in the Capay Valley since 1970. Most of this has resulted from parcelling of pasture and foothill lands into ranchette-type development. No land in the Capay Valley, other than steep rangeland, sells for less than $1,500 an acre, and land suitable for homesites would generally run at least $12,000 per acre.

77. The highest priced agricultural land in the basin is found north and south of Woodland and averages $2,400 per acre and up. Land within the settling basin has been valued at about $600 per acre. Agricultural land throughout the remainder of the basin averages $2,400 and $2,000 an acre for Class I and II soils, respectively. Acreage suitable for dryland farming and field crops will range from $800 to $1,000 per acre. Rangeland averages about $300 per acre. Agricultural land along Cache

Creek with gravel rights averages about $2,000 per acre. Several gravel plants have been actively buying sand and gravel reserves which will provide extractable material for the next 30 years. Bottom lands within the creek, without gravel rights, are valued between $500 and $700 per acre.

78. In Woodland prices have ranged from $6,500 to $18,000 per acre for industrial properties sold.

Personal Income

79. At the close of 1973 it was estimated that median family income in the Clear Lake area would reach 65 percent of the statewide average. However, personal income has gained substantially during the last two decades. The median income of all families within the basin in 1970 was $6,551, compared with the California average of $10,732. Per capita income in 1970 was $2,772. Personal income by source in 1970 was as follows (in thousands of dollars):

Wages & Salaries	Other Labor Income	Proprietors Income	Property Income	Transfer Payments	Total
$20,995	$945	$9,331	$12,621	$13,909	$57,801

Source: 1970 Census of Population, Social and Economic Characteristics.

80. An unusually high percentage of income is derived from transfer payments, with Social Security representing the largest portion of these payments. In 1975, 8,600 persons collected $1,721,000 monthly, or

$20,652,000 annually. However, 35 percent of Social Security recipients are below the poverty level. The second largest allocation of transfer payments is for public assistance. In 1974, there were 1,450 public aid recipients.

81. Rural nonfarm income per family is lower than the countywide average, although rural farm income is substantially higher than average. Median family income is highest in the Lakeport area and lowest at Clear Lake Highlands.

82. The median income of all families of Yolo County in 1970 was $9,482, compared with the California average of $10,732. Per capita income in 1970 was $2,990. In 1970 personal income by source was as follows (in thousands of dollars):

Wages & Salaries	Other Labor Income	Proprietors Income	Property Income	Transfer Payments	Total
$242,016	$10,111	$49,064	$40,966	$38,923	$381,080

Source: 1970 Census of Population, Social and Economic Characteristics.

83. Wages for all nonagricultural occupations are below State averages. However, farm managers and farm laborers receive annual wages higher than the California average. Despite this, agricultural employees are second only to women as the lowest income group in the area. Farm income of the self-employed is also considerably lower than the average family income in the area.

84. In contrast to the Clear Lake area, only about 10 percent of personal income distribution is from transfer payments. In 1973, there were 4,207 public aid recipients in the county receiving a large share of the transfer payments. Among Social Security recipients, 8.3 percent are below the poverty level.

85. Income levels are depressed in the rural communities of the basin. Average income level per family in 1970 ranged from $9,635 in Woodland to $3,000 in Capay. Welfare recipients exceed 70 percent of the population in some areas.

Employment and Labor Force

86. Lake County employment has been characterized by relatively slow growth in numbers of new jobs and by a general lack of employment opportunities. The rate of unemployment for the past two decades has been substantially higher than State or national averages for the same period. The average rate of unemployment in 1972 was 11.4 percent compared with 12.6 percent in 1971. This rate varies seasonally. During winter, it is not uncommon for unemployment rates to reach 16 to 17 percent, compared with 4 to 5 percent in the peak employment summer months. This reflects the dependence of the regional economy on agriculture and trade and service jobs relating to summer recreation.

87. Commercial trade and services represent the largest source of employment. This sector has become increasingly important in the total

employment picture, although the growth rate has been slow. Relative employment in agriculture and food processing has generally declined since 1950.

88. Employment characteristics, based on the 1970 census, are shown in table B-6. About 85 percent of the total work force is employed within Lake County.

89. In the past 5 years in Yolo County, industry has expanded and employment diversified. However, since agriculture remains the most important influence on the labor market, seasonal unemployment is serious in the rural areas during the winter. Unskilled workers generally are surplus throughout the year. Employment in agriculture is declining, while employment is increasing in manufacturing, government, and service and trade categories. Employment characteristics for 1970 are shown in table B-7.

90. Approximately 67 percent of the work force is employed within Yolo County. The second largest center of employment is the Sacramento Metropolitan Area. The majority of all industrial workers are unionized, but fewer retail service and trade workers are unionized. Agricultural workers are generally nonunion. Skilled labor is plentiful. There are also a large number of professionals because the University of California is located at Davis.

TABLE B-6

Employment Characteristics for Lake County: 1970

Employment status		
Total labor force	6,365	
Civilian labor force	6,350	
Civilian employment	5,793	
Percent unemployed	8.8	
Industry of employed persons	**Number**	**% Distribution**
Agriculture, forestry, & fisheries	685	11.8
Mining	62	1.1
Construction	665	11.5
Manufacturing	295	5.1
Durable goods	(169)	(2.9)
Nondurable goods	(126)	(2.2)
Transportation, communications, & sanitary services	403	6.9
Wholesale and retail trade	1,245	21.5
Finance, insurance, business, & repair services	479	8.3
Professional and related services	1,617	27.9
Public administration	342	5.9
Total employed	5,793	100.0%

Source: 1970 Census of Population, General Social and Economic Characteristics.

TABLE B-7

Employment Characteristics for Yolo County: 1970

Employment Status		
Total labor force	36,517	
Civilian labor force	36,334	
Civilian Employment	33,786	
Percent Unemployed	6.3	
Industry of employed persons	**Number**	**% Distribution**
Agriculture, forestry, & fisheries	2,652	7.9
Mining	145	.4
Construction	1,797	5.3
Manufacturing	2,914	8.6
Durable goods	(902)	(2.7)
Nondurable goods	(2,012)	(5.9)
Transportation, communications, & sanitary services	2,421	7.2
Wholesale and retail trade	6,152	18.2
Finance, insurance, business, & repair services	1,950	5.8
Professional and related services	12,910	38.3
Public administration	2,845	8.4
Total employed	33,786	100.0

Source: 1970 Census of Population, General Social and Economic Characteristics.

91. Business in Lake County is typically small and owner-operated. A limited number of outside people are employed with an increase in part-time help during the peak summer months. Large chain stores are almost nonexistent, and there are no nationally franchised restaurants typical of many resort areas. In the resort areas around the lake rim, strip development is the rule. Lakeport, with a marketing area population of 12,000, is the business center of the basin.

92. There is little industry in the basin; the largest plants are associated with processing and packing of pears and walnuts. There are 40 small manufacturing firms in the county; the average employs one to two people. Approximately 6,500 acres of potential industrial land is zoned unclassified, is open to unlimited uses, and is privately owned.

93. Business has grown gradually, with no big peak periods. The two major commercial enterprises in the basin are recreation and agriculture. Other major types of business and industry in 1973 were real estate ($10 million), construction ($6 million), and aggregates and materials ($1 million). Total taxable sales in 1973 was $48,929,000.

94. Woodland is the business and industrial hub in the vicinity of the lower part of the basin. It provides goods and services for its own population as well as for the surrounding rural areas. The main street

of Woodland has traditionally been the central business district and consists of a number of relatively small businesses of the services and trade type, as well as a number of major banking branches. There are three major shopping centers within the city limits, and they are absorbing an increasingly large share of the area's retail sales.

95. Although a growing number of larger discount stores are located in the shopping centers, the average business remains small and generally owner-operated, employing a small number of permanent employees.

96. The other rural communities in the lower portion of the basin have only limited businesses which are farm related or provide such essentials as gas and groceries. Of these communities, Esparto has the greatest number of business and service facilities, while the number of business establishments has declined in other communities.

97. In 1976 taxable retail sales in Yolo County were $392,214,000, with $110,787,000 reported for the City of Woodland.

98. Manufacturing is rapidly increasing in the Woodland area. There are 481 acres zoned industrial within the city limits, and the bulk of development radiates north and east of Woodland. Measured by employment and payrolls, food processing accounts for two-thirds of all manufacturing. There is, however, a growing number of nonagriculturally oriented industries ranging from small to medium size. There is no industrial activity in the rural areas.

99. Mineral production, although not important in comparison to statewide averages, has been increasing. Gas production in 1976 was 22,165,000 million cubic feet (mcf), valued at $21,380,000, compared with 20,926,000 mcf in 1975, valued at $10,949,000. Cache Creek supplies the bulk of the sand and gravel for construction in the county. In 1970 sand and gravel production was valued at $4,050,276. Nine companies are currently operating in Cache Creek.

Agriculture

100. In the Clear Lake area, agriculture is exceeded only by recreation in its contribution to the area's economy. In 1975, the gross value of agricultural production was $19,590,000.

101. Lake County has only about 18 percent fertile agricultural land; the rest ranges from marginal to nonproductive. Intensive farming is generally restricted to the level valley lands surrounding Clear Lake. Agriculture in the rest of the area is limited to dry pasture with only minor amounts of irrigated cropland. The mountain lands are suitable mainly for rangeland.

102. Today over half the area under cultivation is in orchards. The main crops, pears and walnuts, account for over 70 percent of the total value of agricultural output. Pear orchards, due to their much higher economic return, are replacing many of the marginal walnut orchards, and wine grapes have recently been introduced as a major agricultural crop.

103. Agricultural Preserves under the Williamson Act now exceed 33,000 acres. In 1971 there were 804 farms and 180,905 acres of farmland. Total cropland harvested was 26,105 acres and land irrigated totaled 19,744 acres.

104. In the lower part of the basin, Yolo County is the lead county in gross revenue from agriculture in the Sacramento Valley. In 1975 the value of all Yolo County crops was $203,060,000. Much of the western portion of the area is composed of rolling terraces and steep uplands which are used for dry farmed grain or range, depending on slope. The remainder of the basin consists of nearly level alluvial fans, flood plains, and basins which are intensely cultivated. Farmlands within the settling basin are level and rich in silty river bottom land. Total irrigated acreage in the Cache Creek area is estimated at about 98,000 acres. Principal crops are orchards, alfalfa, sugar beets, and tomatoes. Rice has declined in importance but is still extensively grown in the Cache Creek Settling Basin. Field crops and truck crops are also grown within the settling basin.

Recreation

105. Recreation is indispensable to the social and economic vitality of the Clear Lake subbasin. Recreational use is estimated at 2.5 million recreation days annually, with an estimated gross expenditure of $30 million. The excellent warmwater fishery is the chief attraction.

106. However, the recreational industry faces a number of problems. Many of the resort units along the lake shoreline were built in the 1930's in a totally different recreational era. In those days a resort typically consisted of a small number of utilitarian cabins where a family would commonly spend its entire annual summer vacation. These resorts no longer fit the recreational preferences of a more affluent and mobile population. Recreational vehicles are becoming more and more popular, and the visitor is likely to spend, at most, a few days at the lake before moving on. Overnight parks for recreational vehicles and camping are increasing. Now, these older resorts are more typically rented permanently by pensioners and single persons. The few "deluxe" motels with full facilities are in demand for the entire season. The motels with only a few units and limited amenities frequently are marginal operations.

107. There are 197 resorts containing 2,427 sleeping units, 91 trailer parks with 2,009 sites, and 64 campgrounds with 1,404 sites in the Clear Lake area. There are also 125 facilities supplying gasoline for boats, 1,348 private docks and piers, 40 boat ramps, 15 beaches, 7 boat repair shops, and 26 marina supply stores.

108. Recreation related to water dependent uses is divided about equally between the north and south halves of the lake.

109. Clear Lake Outlet Channel is used heavily for recreation during all months when fishing is good. The 5-mile channel is reputed to be

the best stretch of black bass fishing in California, and the resorts along the channel are generally full during these months. The carrying capacity of the channel based on boating use is about 264 persons.

110. It is estimated that algae are presently causing a loss of about 1 million activity days of recreation yearly in the Clear Lake area. The lower Clear Lake Highlands area is most eutrophic, with massive algae blooms occurring throughout much of the recreation season. The upper arm also has a significant summer and fall bloom, and the productivity of the Oaks arm falls between that of the other two arms.

111. Recreation is not a significant economic factor in lower Cache Creek. There is a general shortage of all recreational facilities throughout the area, but the deficiency is most severe in the unincorporated areas. There are no State or National Parks and no privately owned public recreational facilities. A private country club is located just south of Cache Creek, below Airport Road. County and city facilities include a park system in Woodland and a 22-acre park with overnight camping adjacent to Cache Creek near Guinda. The Bureau of Land Management controls about 23,000 acres which are open for public use, but the area is rugged and is used primarily by hikers, hunters, and those with off road vehicles.

112. Access to the Cache Creek Canyon is limited between Clear Lake Dam and State Highway 16 at the Colusa-Yolo County line. Fishing, camping,

and picnicking take place where Highway 16 parallels the creek to Rumsey Bridge. Below Rumsey, access is limited to several locations where public roads cross or reach the creek, and most of the land is privately owned and posted.

113. In the past 5 years, "whitewater" boating on the North Fork and the main stem has grown enormously in popularity. The North Fork is runnable in late March in wet years. Downstream from the North Fork, Cache Creek may be used by boaters all summer due to irrigation water released from Clear Lake. The reach from Highway 16 to the Rumsey Bridge is a favorite for kayakers and canoeists. Many local people float this section on inner tubes and rafts. Boating use in the lower North Fork and Cache Creek from the North Fork to Rumsey is estimated at 2,000 to 5,000 recreation days annually. An important recreational activity throughout the basin below Clear Lake Dam is hunting for deer and upland game birds. A number of private hunting clubs maintain blinds in the Cache Creek Settling Basin.

Projected Population

114. As projected by the California State Department of Finance and shown in table B-8, the population of Lake County is expected to increase from 19,548 in 1970 to 58,800 by 2035. This represents a compound growth rate of about 1.71 percent per year, which is less than the historical rate of about 2.5 percent per year for the last 40 years. Concurrently, the population of Yolo County is expected to increase from

91,788 in 1970 to 273,900 by 2035, representing a compound growth rate of about 1.70 percent per year, which is much less than the historical rate of about 3.4 percent per year for the last 40 years. Rates of population growth in the urbanized and urbanizing areas of both counties are expected to differ from rates applicable to the counties as a whole. Population growth along the perimeter of Clear Lake will be limited by availability of space and basic service facilities. It is estimated that the perimeter will support less than twice the present population. Since residential expansion is away from the flood plain, population on the urban fringe of Woodland is expected to increase and follow countywide trends. As a comparison, ER 1105-2-220 requires consideration of OBERS, Series E (Sacramento Basin Water Resources Region). However, current population levels for the 17-county basin already exceed the projected 1980 level. Therefore, the regional OBERS estimates are shown in table B-8 but are not used.

TABLE B-8

Population Projections for California
and Lake and Yolo Counties (1985-2035)

	1985	1995	2005	2015	2025	2035
LAKE COUNTY						
State of Calif. 1/	31,600	36,500	40,700	46,100	52,000	58,800
OBERS, Series E 2/	29,600	32,100	34,100	36,100	38,100	40,100
YOLO COUNTY						
State of Calif. 1/	133,000	161,100	187,600	213,900	241,500	273,900
OBERS, Seris E 2/	124,500	135,000	143,600	151,900	160,200	168,500
CALIFORNIA						
State of Calif. 1/	24,363,000	27,726,000	30,948,000	34,705,000	38,670,000	43,226,000

Sources: 1/ Population Projections for 1985-2015 by the California State Department of Finance; Projections for 2025 and 2035 by Sacramento District, Corps of Engineers.

2/ Population projection for 1985-2015 by OBERS, Series E, based on Sacramento Basin Water Resources Region. Projections for 2025 and 2035 by Sacramento District, Corps of Engineers.

Projected Income

115. Future income estimates for Lake and Yolo Counties are based on the 1972 OBERS Projections made for the Water Resources Council by the U.S. Department of Commerce. It was assumed that those projections made for the non-Standard Metropolitan Statistical Area portion of the Sacramento Water Resources subarea would be generally valid for Lake County, while the Sacramento Standard Metropolitan Statistical Area (SMSA) would be applicable to Yolo County.

116. Income projections released by OBERS indicate that per capita personal income for Lake County is expected to increase in terms of 1967 constant dollars from $2,820 in 1972 to $16,435 by 2035. This level of increase represents an average annual growth rate of about 2.8 percent, which is greater than the historical rate of about 1.9 percent per year for the 22-year period from 1950 to 1972.

117. During this same 22-year period, Yolo County experienced an average annual rate of growth of 1.4 percent. Projections by OBERS indicate, however, that per capita personal income for the county is expected to increase on a 1967 constant dollar basis from $3,400 in 1972 to $18,180 by 2035, or at an average annual growth rate of about 2.7 percent. For comparison, per capita personal income projections for Lake and Yolo Counties and California are shown in table B-9.

TABLE B-9

Per Capita Personal Income Projection
for California and Lake and Yolo Counties
(1985-2035) (1967 Dollars)

Year	California	Lake County	Yolo County
1972(a)	3,970	2,820	3,400
1985	5,925	4,150	4,920
1995	7,730	5,545	6,445
2005	10,100	7,410	8,450
2015	12,740	9,635	10,870
2025	16,100	12,525	13.980
2035	20,275	16,435	18,180

Source: Growth rates for 1985-2035 adopted from 1972 OBERS Projections.
(a) Per capita income for 1972 from California Statistical Abstract.

Employment Projection

118. Recent OBERS projections indicate that the ratio of the civilian labor force to population will increase slightly in the future. The rising participation rates are expected to result primarily from rising employment of women, which is expected to more than compensate for the declining rates of participation by young men who are remaining in school and by older men who are retiring earlier.

119. Table B-10 shows projected civilian employment for Lake and Yolo Counties with allowances made for anticipated changes in relative labor participation rates and in relative employment rates.

120. In future years total employment in Lake County is expected to depend more on commercial trade and services than it does at present. There should also be a substantial increase in government employment as more public education services are offered by the county. A reduction in the amount of seasonal unemployment and a reduction in the annual average rate of unemployment are anticipated as the economy becomes less dependent on agriculture.

121. Civilian employment categories in Yolo County which can be expected to increase most are local government, finance, services, trade, construction, manufacturing, and State government. Future civilian employment in Yolo County will rely less on agriculture, which traditionally has had high seasonal unemployment rates.

TABLE B-10

Projected Civilian Employment In
Lake and Yolo Counties for 1985-2035

	1985	1995	2005	2015	2025	2035
LAKE COUNTY						
Population	31,600	36,500	40,700	46,100	52,000	58,800
Participation Rate, %	38	38	40	40	40	41
Civilian Employment	12,008	13,870	16,280	18,440	20,800	24,108
Manufacturing Employment,%	5.50	5.40	5.40	5.35	5.35	5.35
Manufacturing Employment	660	749	879	987	1,113	1,290
YOLO COUNTY						
Population	133,000	161,100	187,600	213,900	241,500	273,900
Participation Rate, %	40	40	42	42	42	42
Civilian Employment	53,200	64,440	78,792	89,838	101,430	115,038
Manufacturing Employment, %	20.1	19.3	18.7	18.1	17.6	17.1
Manufacturing Employment	10,693	12,436	14,734	16,261	17,851	19,692

Source: Population projections by the California State Department of Finance; participation ratios adopted from projection by the Bureau of Economic Analysis.

SECTION C

PROBLEMS AND NEEDS

PROBLEMS AND NEEDS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

TABLE OF CONTENTS (Cont'd)

LIST OF PLATES

LIST OF PLATES (Cont'd)

SECTION C

PROBLEMS AND NEEDS

1. This section includes a description of the status of existing flood control and water related plans and works in the area and an identification of water resource problems and needs. Flood, erosion, and sediment problems, municipal and industrial water supply needs, irrigation needs, water quality problems, fish and wildlife needs, general recreation and improvements needed and desired are discussed.

Status of Existing Plans and Improvements

Lakeport Lake

2. In the upper portion of the basin, the Lakeport Lake project on Scotts Creek was authorized for construction by the Corps of Engineers by the Flood Control Act of 1965. The first phase preconstruction studies were completed in July 1973. The proposed lake would have a storage capacity of 55,000 acre-feet. The facility would be operated to

provide flood control to downstream areas along Scotts Creek and a degree of flood control to Clear Lake; a municipal and industrial water supply of 8,400 acre-feet annually; an irrigation water supply of 9,100 acre-feet annually; water-oriented recreation; and fish and wildlife enhancement. The project is currently deferred pending receipt of the necessary assurances.

Middle Creek

3. Adjacent to the Scotts Creek Basin is the Middle Creek Basin where the Corps of Engineers constructed levees for flood control. This project, the Middle Creek Improvement Project, was authorized by the Flood Control Act of 1954 and includes levees and incidental channel improvements on Middle Creek, a channel for diversion of Clover Creek overflows to Middle Creek above the town of Upper Lake, levees on lower Scotts Creek, and pumps for discharge of drainage water entrapped by project levees. The majority of these structures were completed in November 1959.

Lower Cache Creek

4. As part of the Sacramento River Flood Control Project, authorized by the Flood Control Act of 1917, as modified by the Acts of 1928, 1937, and 1941, the Corps of Engineers completed construction of the Cache Creek Settling Basin in 1937. The settling basin, located in Yolo County about 2 miles east of Woodland, is bounded by levees on all sides and covers approximately 3,600 acres. The basin's fundamental purpose

is to preserve the floodway capacity of the Yolo Bypass by entrapping the heavy sediment load carried by Cache Creek. Throughout the life of the project, internal "training" levees have been manipulated to partly control sediment deposition and make best use of basin storage. Following is a brief history of development of the basin.

5. As previously mentioned, the initial project levee construction was accomplished in 1937 when training levees, which also constituted the levees along the northern edge of the basin, were constructed. The southern levee along the Sacramento Northern Railroad track was constructed in 1940, and the "Cobble Weir" was constructed in 1944. A levee was not built on the western boundary of the basin because rights-of-way were acquired only to the 32-foot contour, USGS Datum. This was considered to be the westerly limit to which waters would spread.

6. In 1940, the west training levee, originally constructed in 1937, was moved 400 feet to the west, and in 1950 the training levees existing at present were constructed. In 1943 levees were constructed along Cache Creek from the mouth of the settling basin to Yolo, providing for a capacity of 20,000 cfs. In 1961, these levees were extended approximately 3 miles upstream of the town of Yolo, and the entire settling basin levee system was strengthened to convey a design flow of 30,000 cfs. In 1973 the Cobble Weir was raised 2 feet by the State of California to provide additional sediment storage capacity.

7. Operation and maintenance responsibility for the settling basin, which is essentially filled with sediment, rests with the State of California.

Soil Conservation Service

8. The Soil Conservation Service constructed two small dams, one on Adobe Creek and the other on its tributary, Highland Creek. These reservoirs provide flood protection to the 4,000-acre flood plain along lower Adobe Creek.

Lake County

9. The National Flood Insurance Act of 1968 required nonstructural measures to be taken along Clear Lake rim. As required by the National Flood Insurance Program, Lake County has enacted ordinances to control and regulate land use and construction within the 100-year flood plain (land area inundated once per hundred years, on the average). The Corps of Engineers prepared, for the Federal Insurance Administration (FIA), flood insurance studies dated December 1971 and May 1972 for the unincorporated areas of Lake County and Lakeport, respectively. These studies have been updated and expanded and in March 1977 were submitted to the FIA for approval.

Yolo County

10. The Yolo County Flood Control and Water Conservation District (YCFC & WCD) has completed construction of Indian Valley Reservoir on North

Fork Cache Creek. The reservoir controls a drainage area of 121 square miles and has a storage capacity of 300,000 acre-feet of which 40,000 acre-feet is for flood control storage. Irrigation water from Indian Valley Reservoir, in addition to that from Clear Lake, is provided to agricultural lands in Yolo County.

11. Currently, an irrigation system owned and operated by YCFC & WCD provides water from Clear Lake to 20,000 acres of agricultural land. On 1 October 1967, the District acquired from the Clear Lake Water Company the water rights to the canals and other facilities of the irrigation system. The Clear Lake Dam and the Capay and Moore diversion dams, located in the lower reaches of Cache Creek, are included in the system. An extensive network of canals and ditches distributes the irrigation water diverted by the Capay and Moore Dams.

Flood Problems

Storm Characteristics

12. Major flood producing storms over central California are generally associated with storm systems that originate at about 30 to 50 degrees north latitude and develop a moist air influx trajectory from about the

latitude of the Hawaiian Islands. As the system approaches the coast, the trajectory is over cooler water, thus retarding release of moisture until the air mass is borne inland. There the Coast Range and Sierra Nevada lift the air mass and cause condensation and release of moisture. As the air passes over the Coast Range, some moisture is precipitated. This lifting effect combined with some convergence accounts for the major portion of Cache Creek Basin precipitation. Low foothill and valley precipitation is largely attributable to convergence.

13. The major portion of the annual precipitation and all of the flood producing storms in the basin occur during the period October through April. All of the major floods have resulted from general rainstorms. Normal annual precipitation varies from a maximum of more than 60 inches in the upper portion of Kelsey Creek to a minimum of about 17 inches near the community of Yolo and averages about 32 inches over the watershed. Normal annual precipitation isohyets are shown on plate C-1. Snowfall is rare and has no significant effect on floodflows.

Streamflows

14. Streamflow and lake stage records are available for several gaging stations operated by the U.S. Geological Survey (USGS) and the California Department of Water Resources on streams in the study area. Locations of these gages are shown on plate C-2. Average annual runoff measured at some of these gaging stations is tabulated below.

TABLE C-1
STREAM GAGING STATIONS

Location	Drainage Area (sq mi)	Period of Record Used	Length of Record (Years)	Average Annual Runoff (acre-ft)	Station Operator
Clear Lake at Lakeport	528	1913-1971	59	5.00 1/	USGS
Cache Creek near Lower Lake	528	1944-1971	28	235,600	USGS
North Fork Cache Creek near Lower Lake	197.0	1930-1971	42	142,000	USGS
Bear Creek near Rumsey	100	1958-1971	14	33,250	DWR, CALIF.
Cache Creek above Rumsey	955.0	1965-1971	7	560,000	DWR, CALIF.
Cache Creek near Capay	1,044.0	1942-1971	30	478,200	USGS
Cache Creek at Yolo	1,139.0	1903-1971	69	379,600	USGS

1/ Average annual lake stage in feet above datum of gage, 1,318.65 ft.

15. Pertinent data for gaging stations previously mentioned are shown in the following table.

TABLE C-2
PEAK FLOW AND VOLUME DATA OF RECORD

Gaging Station	Flood Date	Maximum Lake Stage (ft)	Peak Flow ft³/sec.	3-Day Volume (acre-ft)
Clear Lake at Lakeport	27 Feb 58	10.88	-	-
	22 Dec 64	4.10 1/	-	-
	8 Jan 65	9.10	-	-
	23 Jan 70	10.47	-	-
Cache Creek near Lower Lake	24 Feb 58	-	8,000	30,550
	22 Dec 64	-	5 1/	
	5 Jan 65	-	5,320	23,270
	23 Jan 70	-	6,320	26,620
North Fork Cache Creek near Lower Lake	24 Feb 58	-	13,500	31,860
	22 Dec 64	-	19,700	61,800
	5 Jan 65	-	15,700	40,060
	23 Jan 70	-	16,000	37,410
Bear Creek near Rumsey	22 Dec 64	-	6,820	10,680
	5 Jan 65	-	9,720	12,710
	23 Jan 70	-	5,900	10,400
Cache Creek above Rumsey	5 Jan 65	-	59,000 2/	-
	24 Jan 70	-	43,400 2/	99,970
Cache Creek near Capay	24 Feb 58	-	51,600	98,980
	23 Dec 64	-	32,400	84,350
	5 Jan 65	-	44,500	96,620
	24 Jan 70	-	36,200	92,230
Cache Creek at Yolo	25 Feb 58	-	41,400	102,230
	23 Dec 64	-	26,200	79,360
	6 Jan 65	-	37,800	97,420
	24 Jan 70	-	34,600	97,730

1/ Value is concurrent to values at other stations for the same flood.
2/ Value appears unreasonably high, possibly due to the extension of low flow rating table and slope-area measurements.

GENERAL

16. An investigation of precipitation and runoff data for major floods in Cache Creek Basin indicated that reliable data were available only for the December 1964, January 1965, and January 1970 floods. Additional hydrologic information is contained in the "Cache Creek Basin Standard Project Flood Office Report" prepared by the Sacramento District Corps of Engineers and approved by the Division Engineer, South Pacific Division, on 1 July 1974. Hydrographs for these floods are shown on plates C-3 through C-7. Reconstitutions of these floods were used to develop the basic hydrology for Cache Creek Basin. For hydrologic analysis the basin was divided into nine subareas below Grigsby Riffle, as shown on plate C-8. In addition, the area above Grigsby Riffle was divided into 55 subareas.

STORM ANALYSIS

17. Basin mean precipitation for each storm analyzed was determined from storm isohyetal maps developed from available rainfall data. The isohyetal maps for the three major storms investigated are shown on plates C-9 through C-11. Time distribution for the storm amounts was based on Mahnke, Potter Valley 3 SE, Clear Lake Highlands, and Brooks Farnham Ranch rainfall records. Pertinent data for these stations are shown in table C-3.

TABLE C-3
PRECIPITATION STATIONS

Station Name	Elevation (feet)	N.A.P.1/ (inches)	Present Type	Year Begun	Operator
Mahnke	2380	47.7	Hourly	1957	Mrs. E. Mahnke
Potter Valley 3 SE	1100	44.2	Hourly	1953	USCE 2/
Clear Lake Highlands	1320	23.6	Hourly	1941	Carl A. Potts
Brooks Farnham Ranch	294	20.0	Hourly	1941	Mrs. Joyce A. Farnham

1/ NAP - Normal Annual Precipitation
2/ USCE - U.S. Army, Corps of Engineers

BASEFLOW

18. Baseflow as used in the reproductions of the 1964, 1965, and 1970 floods on North Fork Cache Creek near Lower Lake and Bear Creek near Rumsey was estimated to be equal to the flow at the beginning of the floods, increasing uniformly until it intercepted the extension of the recession limb of the observed hydrographs. Baseflow could not be determined accurately for the gages at Rumsey, Capay, and Yolo since high sustained outflows from Clear Lake combined with a substantial rate of seepage into aquifers in this portion of Cache Creek Basin tend to obscure the actual baseflow. Satisfactory reproductions were obtained

assuming no baseflow from the local areas below Clear Lake and the gages on the North Fork Cache Creek and Bear Creek.

UNIT HYDROGRAPHS

19. Preliminary unit hydrographs for the gaged areas analyzed were derived from the flood reproductions mentioned earlier. Samples of the preliminary unit hydrographs are shown on plates C-14 and C-15. Summation curves (S-curves) developed from these unit hydrographs were all quite similar to an average S-curve derived for other studies in the Clear Lake area. This average S-curve, shown on plate C-12, together with the lag relationship, shown on plate C-13, was adopted to develop unit hydrographs for the various subareas in the watershed. These unit hydrographs were then used for the final historical flood reconstitutions in Cache Creek Basin. This procedure for developing unit hydrographs is outlined in the Department of the Army's Technical Bulletin 5-550-3, "Flood Prediction Techniques," and in the Corps' Engineering Manual 1110-2-1405, "Flood Hydrograph Analyses and Computations." Pertinent data applicable to the developed unit hydrographs are shown in table C-4. Final unit hydrographs are shown on plates E-7 and E-8.

LOSS ANALYSIS

20. Loss analyses for the historical storms mentioned above indicated uniform loss rates of 0.064, 0.04, and 0.03 inches per hour for North

TABLE C-4
UNIT HYDROGRAPH DATA

Subarea	D.A. (sq mi)	L (mi)	Lca (mi)	S (ft/mi)	$\frac{LLca}{S^{1/2}}$	n	LAG (hrs)
Copsey Creek near Lower Lake Index Point 2	13.20	6.37	2.27	125.59	1.30	0.10	2.65
Cache Creek Local between Index Points 3 and 2, 1	10.76	5.94	3.13	111.12	1.77	0.06	2.99
North Fork Cache Creek-Indian Valley Res. Index point 4	121.00	27.22	13.83	107.46	36.30	0.06	5.64
North Fork Cache Creek Local between Index Points 5 and 4 North Fork Cache Creek near Lower Lake	76.00	17.62	8.35	179.63	10.98	0.06	3.58
Bear Creek near Rumsey Index Point 6	100.00	31.18	13.77	72.17	50.52	0.06	6.40
Cache Creek Local between Index Points 7, and 6, 5, & 3 - Cache Creek above Rumsey	127.30	31.72	16.05	66.84	62.24	0.06	6.92
Cache Creek Local between Index Points 8 and 7 Cache Creek near Capay	91.70	24.73	11.06	100.89	27.22	0.06	5.06
Cache Creek Local between Index Points 9 and 8	34.30	11.71	7.59	243.39	5.70	0.06	2.79
Cache Creek Local between Index Points 10 and 9	60.70	24.73	16.70	62.68	52.14	0.06	6.47

Fork Cache Creek, Cache Creek local above Rumsey and Bear Creek, and Cache Creek below the Rumsey gage, respectively. Uniform loss rates applied for the various areas above Clear Lake Dam range from 0.045 to 0.061 inches per hour. These uniform loss rates compare favorably with loss rates used in adjacent watersheds.

21. In the lower part of Cache Creek Basin, between Rumsey and Yolo, differentiating between loss rates is difficult due to ponding, infiltration, and channel losses due to seepage from the streambed into the underlying aquifers. 1/ 2/

FLOOD FREQUENCY

22. Rain flood (peak and volume) frequency curves were developed from historical data for three stream gaging stations in the area. These stations are: (a) Cache Creek above Rumsey, (b) Cache Creek near Capay, and (c) Cache Creek at Yolo. Their respective rain flood frequency curves are shown on plates C-16 through C-18. These curves do not include the effects of Indian Valley Reservoir, which was not in existence for the period of record: 1943-1971 for Rumsey and Capay and

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1/ Yolo County, Investigation of Groundwater Resources, May 1976, Clendenen & Associates -- Consultants, Inc., Auburn, California.

2/ Aggregate Extraction in Yolo County, August 1976, Woodward-Clyde Consultants Consulting Engineers, Geologist and Environmental Scientists.

1902-1971 for Yolo. However, preproject and postproject peak flow frequency curves, shown on plate E-9, reflect Indian Valley Reservoir operation subsequent to its construction in 1974. Runoff volume frequency curves were also developed for the area above Clear Lake Dam and the local areas below Clear Lake and the North Fork Cache Creek gage and above the Cache Creek near Rumsey gage. These curves were found to be similar to pattern in volume frequency curves for the North Fork Cache Creek near Lower Lake gage. Therefore, the volume frequency curves for the aforementioned gage were adopted for use in developing a 20-day SPF-series for reservoir regulation studies and preparation of project flow-frequency curves. A stage-frequency curve was also prepared for Clear Lake and is shown on plate E-11.

WAVE RUNUP AND WIND SETUP

23. Wave runup and wind setup on Clear Lake depend mostly on a specific wind direction and velocity. Since there is no climatological station available within the Clear Lake watershed, the Pacific Gas and Electric "Cloverdale Peak" climatological station, located about 15 miles to the southwest of the city of Lakeport, was used. It is the closest and most representative station. Wind data of this station were used in fetch analyses at various locations on the Lake perimeter. Pertinent fetch (FE), runup (Rs), and wind setup (S) data are tabulated below. Wind index locations are shown on plate C-19.

WIND INDEX LOCATION	WIND DIRECTION	DESIGN WIND VELOCITY (MPH)	DESIGN WIND DURATION (MINUTES)	Rs & S (FEET)	Fe (MILES)	ESTIMATED LENGTH OF SHORELINE AFFECTED (MILES)
1. Rocky Pt. at Jago Bay	NW	24.0	50.0	0.85	2.8	55.4
2. Soda Bay, Lake County	NW	23.0	87.0	1.31	6.1	10.7
3. Community of Nice, Lake County	S	45.2	69.0	3.26	6.4	12.9
4. Community of Lucerne, Lake County	WSW	24.8	81.5	2.02	5.7	6.0
5. Shirley Slough, Lake County	N	25.6	78.5	2.07	5.6	15.0

By weighting Rs + S by the length of shoreline affected to the estimated total length of shoreline of about 100 miles, the average Rs + S was calculated to be 1.5 feet. However, to assure a conservative analysis based on the above fetch data and the paucity of available wind data, an average wave runup plus wind setup of 1 foot was adopted for determining damages around Clear Lake. Above data were used for an economic sensitivity study, as described in Section F of this report.

24. The amount of sediment flowing into Clear Lake cannot be determined accurately, because actual data are not available. However, the USGS 1/ estimated the average annual suspended sediment yield to be at least 300 tons per square mile. The USGS also estimated that bedload ranges from 2 to 7 percent of the annual suspended sediment load. Based on the above values the estimated average annual suspended sediment discharge would be at least 70 acre-feet per year. The Scotts Creek watershed is not included in the total tributary area to Clear Lake for sediment yield computations because Tule Lake, located near the mouth of Scotts Creek, acts as a sediment trap. Sedimentation for Lower Cache Creek Basin is described in paragraphs 57 through 73.

Flood Characteristics

25. Floods in the basin are principally caused by runoff of high-intensity rainstorms during winter and spring. Since reaches of the streams are relatively short and channel gradients are steep, peak floodflows usually pass completely through the basin within 24-hour periods. The effects of such floods are different for the upper and lower areas of the basin.

1/ U.S. Geological Survey - Water Supply Paper No. 1798-J.

26. The shoreline of Clear Lake has been subject to flooding throughout its history. The flood problem is caused primarily by the lake's restricted outlet channel, which has a discharge capacity of about 2,500 cfs at elevation 7.56 feet on the Rumsey gage at Lakeport (1326.21 feet, m.s.l. datum) and a maximum of about 8,000 cfs at extreme flood stage. Since historical flood inflows into the lake exceed 40,000 cfs, floodwater must be stored temporarily in the lake.

FLOOD CONTROL OPERATIONS

27. Enlargement of the outlet channel is currently prohibited by the Gopcevic and Bemmerly Decrees. The Gopcevic Decree was issued in 1920 by the Mendocino County Superior Court as a result of a suit between certain property owners bordering Clear Lake and the Yolo Water and Power Company, predecessor to the Clear Lake Water Company. The decree prescribes certain maximum and minimum stages of the lake and orders damages to be paid in case of violations. It also prohibits any widening, deepening, or other enlarging of the outlet channel. This decree may have to be modified before Clear Lake flood control operations could effectively solve flood and irrigation problems. Clear Lake Dam, currently operated by Yolo County for water supply and flood control, is capable of discharging much higher flows than have historically been released. Plate C-21 contains a sketch of the dam face and information on the discharge capacity of the dam. In 1977 the State of California investigated the safety of the dam and determined

that it was structurally adequate for full operation, and the spillway could pass the 1- in 1,000-year event (24,900 cfs) with adequate freeboard (2.5 feet). The two most important provisions of the Gopcevic Decree for operation of the lake are given below. (A copy of the decree is in appendix 3.)

a. The maximum stage of Clear Lake cannot exceed 9.0 feet on the Rumsey gage at any time. Stages between 7.56 and 9.0 feet are permitted for up to 10 successive days for the temporary storage of floodwaters.

b. The minimum stage of the lake is set at zero on the Rumsey gage. In making releases from the lake, irrigation, evaporation, and other losses for the ensuing season must be considered.

28. After the February 1938 flood caused extensive damage around the Clear Lake rim, lake interests requested the State of California to enlarge the Clear Lake Outlet Channel to permit reduced flood stages on the lake, since the lake could not be controlled to the provisions of the Gopcevic Decree. However, property owners along Cache Creek in Yolo County obtained an injunction restraining the State from widening or deepening this outlet because such construction would result in higher floodflows and consequently increase damages in the lower reaches of Cache Creek. The injunction, known as the Bemmerly Decree,

was issued by the Yolo County Superior Court and upheld by the District Court of Appeals. (Appendix 3 contains a copy of this decree.) However, operating within the limits set by the Gopcevic Decree is not physically possible with the existing outlet channel. Records of water surface elevations in Clear Lake since 1874 show that elevation 7.56 has been exceeded 41 times and that elevation 9.0 has been exceeded 24 times.

FLOODS OF RECORD

29. All record floods in the Cache Creek Basin have been rain flood type characterized by relatively high peaks of short duration and relatively small total volume. However, these characteristics are modified somewhat in the lower Cache Creek area by Clear Lake, which acts as a regulating reservoir. As indicated, the outflow from the lake is limited by the existing outlet channel. Nevertheless, the area below Clear Lake along Cache Creek is subject to flooding. Data related to some of the larger historical floods of Clear Lake and Cache Creek are contained in table C-5.

Table C-5
Floods of Record

Year	Month of Peak	Peak Stage (Rumsey gage ft)	Exceedence Interval (Years)
		CLEAR LAKE	
1956	February	9.53	10
1958	February	10.88	38
1965	December	9.10	7
1970	January	10.47	24

Year	Month of Peak	Peak Flow (cfs)	Exceedence With Indian Valley Reservoir (Years)
		CACHE CREEK ABOVE RUMSEY	
1965	January	59,000*	-
1970	January	43,400	150
		CACHE CREEK NEAR CAPAY	
1955	December	31,800	10
1958	February	51,600	180
1965	January	44,500	70
1970	January	36,200	20
		CACHE CREEK AT YOLO	
1956	February	27,400	15
1958	February	41,400	130
1965	January	37,800	70
1970	January	36,600	60

*Estimated.

RECENT FLOOD DAMAGES

30. In February, March, and April 1958, the elevation of Clear Lake reached a maximum of 10.88 feet on the Rumsey gage at Lakeport and exceeded 9.0 feet for 44 days. During all this time the maximum possible release was being made from the lake. In 1958, about 4,000 acres of residential, commercial, and agricultural lands were flooded to a depth of about 2 feet, and water remained in many homes and business establishments for as long as 2 months. The flood of 1958 caused damages estimated at $878,000 in areas adjacent to Clear Lake. In January 1970, Clear Lake reached a stage of 10.47 on the Rumsey gage. About 1,600 acres were flooded around the rim, and damages amounted to $485,000. Table C-6 summarizes the damages reported from these two floods.

Table C-6
Clear Lake Flood Damages
1958 and 1970

Category	1958 Flood ($1,000)	1970 Flood ($1,000)
Residential	440	186
Commercial	312	125
Public Facility	74	115
Agricultural	52	59
Total	878	485
Total in 1977 prices	2,148	828

31. Before the design capacity of the Cache Creek levees downstream of Yolo was increased from 20,000 to 30,000 cfs in 1961, a levee break in this area occurred in February 1956, causing 700 acres to be flooded. In February 1958 the levees successfully held a peak flow of 41,400 cfs. However, the levees were under constant surveillance, and critical areas were sandbagged to prevent major flooding. At the same time, Cache Creek overflowed its banks upstream from the levees, flooding farmlands and roads. Flood damage along the lower reaches of Cache Creek during the 1958 flood was estimated to be about $520,000, as summarized in the following table:

Table C-7
Cache Creek Flood Damages
1958

Category	Damages ($1,000)
Residential	5
Commercial	5
Industrial and utilities	10
Public facilities	276
Agricultural	221
Total	517
Total in 1977 prices	1,299

In 1970, limited flooding in the lower basin adjacent to Cache Creek caused approximately $50,000 ($96,000 in 1977 prices) in agricultural damages, primarily.

EXISTING FLOOD HAZARD

32. Damages to existing development along Clear Lake rim would equal approximately $5,225,000 and $3,680,000, respectively, from flooding under hydrologic and climatic conditions similar to conditions in 1958 and 1970. As previously noted, flood damages along Clear Lake rim result from high lake levels which are increased by high winds. Waves of up to 4 feet on the main lake area and 3 feet on the lower arm have occurred with severe wind and have a substantial impact on potential flood damages. During the 1970 flood, wind velocities were not high enough to create significant wave action. However, if wind velocities sufficient to create average wave heights of 2 feet occurred simultaneously with the peak lake levels reported in the 1970 flood, damages under present economic conditions would be expected to exceed $7 million.

33. Gravel operators have excavated extensively in the channel reach of Cache Creek between Capay and just upstream of the Cache Creek project levees. This excavation has consisted primarily of channel deepening and some widening, and the effect has been a considerable reduction in the overbank flood damage potential in this reach. Local interests and some agencies believe that channel deepening has allowed degradation at bridge crossings and corresponding damage to bridges.

34. The recently completed Indian Valley Reservoir will reduce peak floodflows along Cache Creek downstream of the junction of the creek

with North Fork Cache Creek, thereby resulting in reduced potential for flood damage.

DESCRIPTION OF FLOOD PLAIN AREA OF CACHE CREEK BASIN

35. The flood plains within the study area lie in two different, noncontiguous sectors of the Cache Creek Basin (Clear Lake - lower Cache Creek). For study purposes, the flood plain of lower Cache Creek was divided into three reaches with physical and economic characteristics common within each subarea (see plate A-1). Acreages within the Standard Project Flood Plain of each reach are presented in the following table:

Table C-8
Standard Project Flood Plain Area

Reach	Acres
Clear Lake rim	4,135 1/
1	2,475
2	2,650
3	10,880

1/ For Clear Lake rim agricultural acreage only.

36. The Clear Lake rim flood plain consists of that area adjoining the lake at an elevation above 1,326.2 feet and ranging up to an elevation of approximately 1,331.66 feet at the Standard Project Flood stage. Homes and commercial developments encircle much of the lake. Agricultural crops, including pears, grapes, walnuts, barley, and

alfalfa, are produced on land that is level and fertile enough for such use. Some lands are used for pasture.

37. Reach 1 extends through the Capay Valley from the town of Rumsey to just above Capay Diversion Dam. The creek in this reach flows through a gently rolling terrain comprised of land used predominantly for orchards and field crops with some native forage. Farm improvements, including residences and adjacent farm buildings, occupy approximately 15 of the 2,475 acres within this reach.

38. Reach 2 lies between Capay Weir and Airport Road (also called County Road 94B), located west of the town of Yolo in the Sacramento Valley. Farmsteads within the flood plain occupy approximately 10 acres, and an additional 10 acres is devoted to urban uses. The remainder of the land is used for agriculture. The major features of the terrain are those common to other wide-spreading alluvial fans, that is, mainly flat but with a slight slope and somewhat deep soils with enough natural drainage to be good for crop production.

39. Reach 3 is downstream of Airport Road and terminates at the Cache Creek Settling Basin. About 98 percent of this flood plain is agricultural cropland, and 2 percent (about 185 acres) is urbanized land. Land in agricultural production is intensively used for crops varying from sugar beets to pasturage and orchard crops, including walnuts. The city of Woodland is adjacent to the flood plain with some

fringe areas being flooded infrequently by high flows from Cache Creek. This fringe area includes much of the industrial sector of Woodland. Terrain in Reach 3 on both the north bank and the south bank of Cache Creek is generally flat with deep sediment soils.

DETERMINATION OF FLOOD PLAINS

40. In reaches 1 through 3, flood plains were determined by routing floodflows down Cache Creek from Rumsey to the Cache Creek Settling Basin. HEC-2, Water Surface Profiles computer program, was used in the analysis. As input, field cross sections of the channel were obtained along the entire length of the channel and at all bridges. These cross sections were supplemented with stereo aerial photography, 7-1/2 minute USGS quadrangle maps, numerous field inspections, and field surveys made during and after historic floodflows.

41. Flood plains around Clear Lake rim were determined from a variety of information. Along the southeast portion of the lake, which includes the communities of Clearlake Park and Clearlake Highlands, and the Clear Lake Outlet Channel, aerial photography by the Lake County Sanitation District was utilized. This photography is to a contour interval of 2 feet, with numerous spot elevations. Along the northern portion of the lake, which includes the communities of Lucerne, Nice, and Lakeport, aerial photography by the Lake County Sanitation District again supplemented other available information. It included profiles of the

major highways along the lake rim, in addition to numerous spot elevations. Aerial photography of the entire lake rim by the State of California Lands Commission was also utilized. This photography delineated the location of 0.00 feet on the Rumsey gage at Lakeport (1318.26 feet, m.s.l.). Additional information included USGS quadrangle sheets and aerial photography of historic flood events. Aerial photos of the 1970 flood at a scale of 1" = 2000' were taken at a lake stage of about 10.3 feet and used to verify pre- and post-project flood plains.

42. To further verify the flood plains determined from the information described above and to specifically determine the first floor elevations of structures within the flood plains, extensive field surveys were conducted. Elevations were determined for virtually all units within the SPF flood plain and included data gathered from the lake by boat as well as on land.

PRESENT PROPERTY VALUES

43. An inventory of the damageable units currently occupying the Standard Project Flood Plains, including structural and content values, is presented in the following tables. This inventory does not include land values or such public facilities as roads, bridges, or water and sewage treatment facilities. Flood damages, however, are estimated for these facilities, based on historic data and interviews with local officials.

Table C-9

Clear Lake Rim Damageable
Property Values in 1977

	Units	Average Value	Total Value
Residential Structures 1/	800	$25,040	$20,032,000
Residential Contents 1/	800	8,760	7,008,000
Mobile Home Structures	245	7,420	1,817,400
Mobile Home Contents	245	5,500	1,347,500
Commercial Structures	1,650	-	9,718,200
Motel (units)	1,500	4,400	(6,600,000)
Stores	90	32,160	(2,894,400)
Marina gas facilities	60	3,730	(223,800)
Commercial Contents	1,650	-	3,761,700
Motel (units)	1,500	1,540	(2,310,000)
Stores	90	15,190	(1,367,100)
Marina gas facilities	60	1,410	(84,600)
Total			$43,684,800

1/ Excluding mobile homes.

Table C-10

Cache Creek Damageable
Property Values in 1977

	Units	Average Value	Total Value
Reach 1			
Farmsteads:			
Residential structures	19	$21,300	$404,700
Residential contents	19	7,500	142,500
Farm buildings	11	8,400	92,400
Total			$639,600
Reach 2			
Residential structures	11	$21,700	$238,700
Residential contents	11	7,600	83,600
Commercial structures	1	37,600	37,600
Commercial contents	1	18,800	18,800
Industrial structures	3	31,400	94,200
Industrial contents	3	46,800	140,400
Total			$613,300
Reach 3			
Residential structures	88	$21,600	$1,900,800
Residential contents	88	7,500	660,000
Commercial structures	20	54,500	1,090,000
Commercial contents	20	72,500	1,450,000
Industrial structures	24	533,000	12,792,000
Industrial contents	24	796,300	19,111,200
Total			$37,004,000

FUTURE DEVELOPMENT - CLEAR LAKE RIM

44. Limitation on space and lack of sufficient water and sewage treatment facilities will restrict residential and commercial development in the Clear Lake rim reach. Retirees, recreational

visitors, and others want lakeside homesites. Local zoning and parcel maps, and general plans, show that the lake perimeter will support less than twice the current development if agricultural and other open space areas described in the Open Space Element of the Lake County General Plan are to be preserved. Projections of future residential and commercial units within the flood plain, based on these limitations, are presented in table C-11. It is assumed that all such structures will be constructed with the ground floor above the 11.85-foot elevation, as measured at the Rumsey gage at Lakeport, in conformance with present flood plain management regulations.

45. It is assumed that future industrial and major public facility buildings would continue to locate outside of the flood plain because of the premium land prices for residential and commercial lakeside development. Damageable public facilities such as roads, parks, and water and sewage treatment facilities are expected to increase at a rate proportionate to the increase in residential and commercial units, or approximately 1.35 percent each year during the study period.

46. Although no major changes in total agricultural acreage are projected for the flood plain, changes in crop distributions and yields per acre are projected based on data contained in the California Framework studies. Table C-12 summarizes the existing and ultimate cropping distribution and yield projected for the flood plain area.

Table C-11

Clear Lake Rim Existing and
Projected Units Standard Project Flood Plain

	1977	1985	1995	2005	2015	2025	2035	-	2085
Residential Homes	800	1006	1151	1283	1453	1584	1677		1677
Mobile homes	245	305	353	393	445	471	471		471
Commercial	1651	1658	1688	1720	1772	1786	1798		1798
Private Piers	1324	1463	1580	1674	1778	1842	1842		1842
Agriculture (acres)	4128	4076	4035	3999	3954	3919	3896		3896

Table C-12

Existing and Projected
Crop Distribution and Yield
Clear Lake

	1977		2035	
Crop	Acres	Yield (Ton/acre)	Acres	Yield (Ton/acre)
Alfalfa	155	5.60	200	8.40
Grain	500	1.80	600	3.80
Pasture	790	8.70	900	11.0
Orchards	820	5.84	1200	11.4
Native Pasture	1870	-	1000	-
Total	4135		3900	

Source: 1977 estimates based on field surveys and Lake County Agricultural Crop Reports; 2035 projections adapted from California Framework Studies.

47. No significant increase in residential, commercial, or industrial units is projected for Reaches 1 and 2 during the study period. These reaches are located in a rural portion of Yolo County with predominantly agricultural land use. The Open Space Element of the Yolo County General Plan indicates a majority of this acreage is classified in agricultural preserve status under the California Land Conservation Act (Williamson Act) of 1965. The Sacramento Regional Area Planning Commission (SRAPC) Regional General Plan, Physical Development Element, August 1973, indicates that future urban development projected for this portion of Yolo County can be readily accommodated in existing rural communities such as Madison, Esparto, and Guinda in areas outside of the flood hazard area.

48. Future residential, commercial, and industrial development projected for Reach 3 is presented in table C-13. These projections were based on 1974 Department of Finance population projections modified by present trends to fewer persons per housing unit and the general growth patterns projected for urban development in the Woodland area presented in the SRAPC General Plan (page 21). In the Woodland area, residential and associated commercial development is expected to move in a southerly direction towards the city of Davis and away from the flood plain area. However, some residential development is expected in the northwestern portion of Woodland as current developments extend to areas

subject to moderate flooding from the standard project flood. The growth in housing units in the flood plain area is estimated to average 2.5 percent per annum during the study period (1985-2085). This is higher than the projected 1.65 percent per annum increase in population for Yolo County for the same period because of the present trend to fewer persons per housing unit and the small base of units currently occupying the flood plain area.

Table C-13

Cache Creek - Reach 3 Existing
and Projected Units, Standard Project Flood Plain

	1977	1985	1995	2005	2015	2025	2035	-	2085
Residential	88	106	136	174	223	285	365		365
Commercial	20	24	30	39	49	63	81		81
Industrial	24	30	39	52	69	91	120		120
Agriculture (acres)	10,675	10,620	10,550	10,440	10,300	10,120	9,870		9,870

49. Based on 1972 OBERS projections for the Sacramento SMSA, wholesale and retail trade activities are projected to increase at an average rate of approximately 3.1 percent per year during the study period. Commercial development within the flood plain is expected to be primarily neighborhood retail type, and its growth rate would be less than anticipated for the entire SMSA. Growth of commercial units is therefore projected to average approximately 2.5 percent per annum.

50. Based on the previously mentioned SRAPC Regional Plan and recent construction activities, future industrial development in Woodland will occur primarily in the northeastern portion of the urban area. Much of this area is included in the standard project flood plain of Reach 3. Current industrial activities located in the flood plain include food processing and plastics production plants. Transportation facilities directly serving the area include Southern Pacific Railroad lines and the recently completed Interstate 5.

51. Industrial growth in Reach 3 is estimated to average 2.8 percent per annum during the study period. This rate of growth is slightly higher than the 1972 OBERS projection of 2.65 percent per annum for manufacturing activities in the Sacramento SMSA for a similar period. The higher rate of growth is assumed bacause of the small base of industrial facilities currently located in the immediate flood plain area and the locational advantages for future industrial development created by the recently completed highway system.

52. Currently, no major public buildings are within Reaches 1 through 3, and none are projected for the study period. In the Woodland area, future development of such neighborhood facilities as schools and firehouses is expected to follow the major urban movement to the south away from the flood damage reaches. In Reach 3, increases in damageable public facilities, such as roads, bridges, and water and sewerage facilities, are expected to be commensurate with increases of

approximately 2.25 percent per annum projected in residential, commercial, and industrial development. This same growth rate is assumed for the public facilities which service such rural communities as Madison, Esparto, and Guinda in Reaches 1 and 2.

53. As with the Clear Lake rim reach, no significant reductions in the total acreage devoted to agricultural production is projected for Reaches 1 and 2, while urban development in Reach 3 is expected to remove approximately 825 acres from agricultural production during the study period. The following table summarizes the existing and projected crop distributions and yields for the combined agricultural acreages in Reaches 1 through 3.

Table C-14

Existing and Projected Crop Distributions
Reaches 1-3

Crop	1977 Acres	1977 Yield (Tons/acre)	2035 Acres	2035 Yield (Tons/acre)
Rice	545	2.8	400	4.6
Field	3,000	1.0	3,535	2.2
Truck	2,575	25.0	2,685	52.0
Grain	1,605	2.0	1,580	4.2
Pasture	2,050	3.0	1,560	3.8
Orchard	1,520	1.8	1,700	3.5
Native pasture	4,455	-	3,500	
Subtotal	15,750		14,960	
Farmsteads and urban	255		1,045	
Total	16,005		16,005	

Source: 1977 estimates based on field surveys and Yolo County Agricultural Crop Reports. 2035 projections adapted from California Framework Studies.

FUTURE PROPERTY VALUES

54. For damage and benefit analysis, existing structures are evaluated on the basis of their current market values. New and replacement units are evaluated on the basis of 1977 construction prices and conditions. No increases in value per structure are projected during the study period either for existing or new or replacement units or for the content value of commercial or industrial units. Residential content values, however, are expected to increase over time with increased affluence (increases in per capita income in real terms).

55. Residential content values for the flood plain areas are currently estimated at 35 percent of structural values. Increases in content values during the study period are projected on the basis of anticipated growth in the resident per capita income. Based on the per capita income projections previously presented for Lake and Yolo Counties, residential content values in the Clear Lake and Cache Creek areas are projected to increase at an average rate of 2.84 and 2.7 percent per annum, respectively, until content values reach a maximum of 75 percent of structural values. For both areas the 75 percent limit would be reached before the year 2005. Additional increases in residential content value are not projected beyond the 75 percent limit. The effect of the affluence factor on future residential content values is summarized in tables C-15 and C-16.

FLOOD DAMAGE

56. Average annual flood damages were computed for Clear Lake rim and lower Cache Creek area based on 1977 conditions. These data are presented in table C-17.

Table C-15

Clear Lake Rim - Residential

	1977	1985	1995	2005	2015	2025	2035	-	2085
Residential Structures 1/									
Number of units	800	1,006	1,151	1,283	1,453	1,584	1,677	-	1,677
Average value of structures ($1,000) 2/	25.0	26.4	27.4	28.3	29.3	30.2	30.2	-	30.2
Without affluence									
Average value of contents ($1,000)	8.8	9.2	9.6	9.9	10.3	10.6	10.6	-	10.6
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents ($1,000)	8.8	11.9	15.9	20.1	20.8	21.4	21.4	-	21.4
Percent of structural value	35	45	58	71	71	71	71	-	71
Mobile Homes									
Number of units	245	305	353	393	445	471	471	-	471
Average value of structure ($1,000) 2/	7.4	8.1	8.4	8.6	8.8	8.9	8.9	-	8.9
Without affluence									
Average value of contents ($1,000)	5.5	6.0	6.2	6.4	6.5	6.6	6.6	-	6.6
Percent of structural value	74	74	74	74	74	74	74	-	74
With affluence									
Average value of contents ($1,000)	5.5	6.0	6.2	6.4	6.5	6.6	6.6	-	6.6
Percent of structural value	74	74	74	74	74	74	74	-	74

1/ Excluding mobile homes.
2/ No increase in value is projected for existing units. New and replacement units are evaluated at average 1977 construction prices of $25,000 per home and $12,000 per mobile home. Replacement is based on an average replacement cycle of 55 years.

Table C-16

Cache Creek - Residential Structure And
Content Values, 1977 Prices

	1977	1985	1995	2005	2015	2025	2035	-	2085
Reach 1									
Number of units	19	19	19	19	19	19	19	-	19
Average value of structures ($1,000)	21.3	21.3	21.3	21.3	21.3	21.3	21.3	-	21.3
Without affluence									
Average value of contents ($1,000)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	-	7.5
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents ($1,000)	7.5	9.8	12.8	15.9	15.9	15.9	15.9	-	15.9
Percent of structural value	35	46	60	75	75	75	75	-	75
Reach 2									
Number of units	11	11	11	11	11	11	11	-	11
Average value of structures ($1,000)	21.7	21.7	21.7	21.7	21.7	21.7	21.7	-	21.7
Without affluence									
Average value of contents ($1,000)	7.6	7.6	7.6	7.6	7.6	7.6	7.6	-	7.6
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents ($1,000)	7.6	9.9	12.9	16.2	16.2	16.2	16.2	-	16.2
Percent of structural value	35	47	62	75	75	75	75	-	75
Reach 3									
Number of units	88	106	136	174	223	285	365	-	365
Average value of structures ($1,000)	21.6	21.6	21.6	21.6	21.6	21.6	21.6	-	21.6
Without affluence									
Average value of contents ($1,000)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	-	7.5
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents ($1,000)	7.5	9.8	12.8	16.2	16.2	16.2	16.2	-	16.2
Percent of structural value	35	45	59	75	75	75	75	-	75

Table C-17
Average Annual Damages
1977 Conditions

Location	Average Annual Damage
Clear Lake Rim	$1,339,000
Cache Creek	
Reach 1 (Rumsey to Capay Diversion Dam)	34,200
Reach 2 (Capay Diversion Dam to Airport Road)	30,500
Reach 3 (Airport Road to Settling Basin)	65,000

Erosion and Sediment Problems

57. The erosion and sedimentation problems are primarily confined to the area of Cache Creek below Rumsey. For many years, erosion and sedimentation have been a problem in this area, and numerous acres of land have been washed away. Gradual degrading of the channel between Capay and the settling basin has had a damaging effect on bridges crossing Cache Creek.

Bank Erosion

58. Banks along Cache Creek have eroded between the towns of Rumsey and Yolo downstream of Yolo; the Corps of Engineers has placed bank

protection in conjunction with the constructed levee project. Between Rumsey and Capay, erosion damages are primarily evident along the right bank where agriculture has developed. In the reach between Capay and Yolo, banks have been lost because of erosion and mining of sand and gravel from the channel and bordering lands. In particular, gravel mining downstream of Stevens Bridge has significantly widened the channel. Table C-18 presents types of land subjected to erosion along the channel.

Table C-18
Land Use Along Cache Creek

Reach	Cultivated Lands	Orchards	Pasture	Hillside
		MILES		
Rumsey to Capay (Reach 1)	11.6	10.8	4.7	17.1
Capay to Stevens Bridge (Reach 2)	11.8	1.7	8.9	0

59. In addition to farmsteads, numerous structures crossing and adjacent to the creek have been damaged or are susceptible to erosion damage. These facilities are listed in table C-19 from downstream to upstream.

Table C-19
Structures Crossing Cache Creek
Upstream from Stevens Bridge

Miles Upstream From Settling Basin	Type Facilities	Name
7.0	Road Bridge	Stevens Bridge
8.0	Irrigation Canal	Moore Canal
9.4	Diversion Dam	Moore Dam
9.5	Irrigation Canal	Alder Canal
10.0	Power Transmission lines	
12.2	Power Transmission lines	
12.8	Power Transmission lines	(3 lines)
12.9	Road Bridge	Interstate 505
13.4	Road Bridge	Madison Bridge
16.3	Road Bridge	Esparto Bridge
18.5	Road Bridge	Capay Bridge
20.6	Diversion Dam	Capay Dam
39.7	Road Bridge	Rumsey Bridge

Sediment

60. From the gage located above the town of Rumsey, Cache Creek flows through sedimentary rock formations before entering the Capay Valley. When no longer confined by the steep rock canyon between Clear Lake Dam and Rumsey, the channel widens considerably in the valley, and the creek

gathers a substantial amount of sediment from hillside and sheet erosion. The sediment yield in the Capay Valley between Rumsey and Capay is approximately 3.5 times higher than in the upstream portions of Cache Creek Basin. Table C-20 shows the unit sediment yield of Cache Creek to be high compared with other streams.

Table C-20
Comparision of Sediment Yields

Stream	Location	Drainage Area (1,000 sq mi)	Average Water Discharged (1,000 cfs)	Average Annual Suspended Load (ton/sq mi)
Cache Creek	Capay, CA	0.5	0.6	1,584
San Joaquin	Vernalis, CA	14.0	4.7	25
Eel	Scotia, CA	3.1	7.0	5,846
Colorado	Grand Canyon, AZ	137.8	6	1,082
Columbia	Pasco, WA	102.6	256	100
Missouri	Hermann, MO	528.2	69	454

Source: "The Sediment of Major Rivers of the World" by John N. Holeman. August 1968 issue of Water Resources Research, published by American Geophysical Union.

61. The high sediment inflow to the creek in this reach depends on a number of factors, one of which is the low amount of precipitation in such a relatively steep mountainous area. Because of the low precipitation, there is limited vegetative cover. When precipitation does occur, a large amount of sediment is washed from the hills into the stream.

62. The Capay Hills, located on each side of the stream and forming the Capay Valley, are broken at numerous places by step-like topography where earth surface slump and soil creep have gradually created gullies. The hills to the northwest form the left bank of the creek and discharge hillside sediment directly into the stream. Along the right bank of the creek is the Capay Valley floor that has been extensively cultivated for agriculture, and this cultivation increases the susceptibility to erosion.

Sediment Transport

63. The cross section of Cache Creek in the reach between Capay and the settling basin is typically very wide and shallow. Width to depth ratios are commonly 50 or greater. A low flow channel meanders within the confines of the main channel, occasionally attacking the banks.

64. The stream transports an extremely wide range of grain sizes with a large proportion of fines (0.2 mm) moving as wash load. Although the banks in this reach are composed of easily erodible material, they are probably not a major source of the sediments that deposit in the settling basin. As stated previously, hillside and sheet erosion in the Capay Valley above Capay is the major source of sediment.

65. The amount of sediment transported decreases from Capay to Yolo, 10 miles downstream, because flows are diverted for irrigation and the

energy slope decreases. The average annual total transport at Capay is about 2,115,000 tons and at Yolo 1,297,000 tons. Calculated average annual capacity for transport of bed material is 263,000 tons at Capay and 165,000 tons at Yolo. For the present flow-duration characteristics of Cache Creek, approximately 90 percent of the average annual bed material transport occurs during flows between 1,500 and 11,000 cfs. Transport rates of bed material at Capay and Yolo as functions of discharge and other pertinent sediment information were developed from USGS data and are presented in table C-21. The movement of bed material, as opposed to wash load, is important in determining channel stability.

Table C-21
Sediment Transport
Bed Material Transport Rates, Cache Creek

Discharge (cfs)	Transport Rate (Tons/Day)	
	Near Capay	Near Yolo
50,000	160,000	125,000
30,000	69,000	54,000
20,000	39,000	29,000
15,000	30,000	19,000
10,000	22,000	11,500
5,000	9,600	5,100
3,000	4,300	2,400
1,500	930	700
1,000	400	320
500	115	77

Average Annual Transport Rates in Tons

	Bed Material (0.2 - 20mm)	Wash Load (0.2mm)	Total
Cache Creek	263,000	1,852,000	2,115,000
Cache Creek at Yolo	165,000	1,132,000	1,297,000

66. As the transport capacity at Capay is greater than that at Yolo, deposition within this reach is expected. Gravel mining operations, however, are presently removing about 2.7 million tons of material each year at a rate about two times greater than the stream can replace with upstream bed material. This removal of material has substantially increased the channel width. Annually, about 675 acre-feet of sediment is transported to the Cache Creek Settling Basin.

Sediment Deposition in the Settling Basin

67. The following table (C-22) shows the volume of sediment deposited in the settling basin, based on surveys by the Corps of Engineers in 1933 and 1934 and subsequent topographic surveys by the State in 1958, 1968, and 1971. An average of about 340 acre-feet of sediment was deposited annually in the settling basin from 1937 to 1971.

Table C-22
Deposition in Settling Basin

Period	Acre-Feet
1937 to 1958	9,700
1958 to 1968	1,900
1968 to 1971	1,035
Total	12,635

68. Gradation analyses of the soils of the settling basin and Yolo Bypass were made in March 1972 by the State of California Department of Water Resources. The results of these analyses are shown in the following table.

Table C-23
Gradation Analyses

Location	Sand (larger than .074 mm)	Silt (.005 to .074 mm)	Clay (smaller than .005 mm)
	PERCENT		
Cache Creek at Yolo (inflow)	16	36	48
Settling Basin mouth of training levees	69	23	8
Settling Basin near Cobble Weir	15	62	23
Yolo Bypass	22	42	36

Source: "Cache Creek Settling Basin Interim Plan," by State of California Department of Water Resources, October 1972.

Sediment Characteristics in the Settling Basin

69. Essentially, most of the basin soils are silty fine sands to fine sandy silts with increasing clay content at greater depth. The average maximum dry density is 113 pounds per cubic foot, size ranges from 0.005 to 0.5 millimeters, and optimum water content is 13 percent. The three major soil types are the Maria Series (Mc) and the Laugenour Series (Lh and Lk), which comprise one-third and two-thirds, respectively, of basin deposits. Generally, soils are mildly alkaline and excellent for agriculture, limited only by a slight excess of soluble salts. Except for relatively high weed content, basin deposits are good for topsoil. Soils are also suitable as general construction fill for building sites, highway subgrades, and other similar uses.

Sediment Deposition in the Yolo Bypass

70. Sedimentation in the Yolo Bypass by Cache Creek has again become a problem. In 1937 the Cache Creek Settling Basin was constructed as a unit of the Sacramento River Flood Control Project to control sediment deposition in Yolo Bypass and thus maintain the floodflow capacity of the bypass. However, the settling basin's storage capacity is now almost depleted. As previously stated, the State of California has in recent years modified the Cache Creek Settling Basin by raising the Cobble Weir at the outlet of the basin to provide interim storage capacity until a long range solution can be developed. However, raising this weir has caused encroachment into the freeboard of perimeter levees under design flow conditions.

71. Based on an analysis of the gradation of sediment flowing into the settling basin (675 acre-feet annually) and the sediment that has deposited in the Yolo Bypass, it was determined that an average of about 100 acre-feet per year would deposit when the trap efficiency of the settling basin reached zero. A zero trap efficiency was expected to occur in 1975; however, the interim measure of raising the Cobble Weir has provided some prolonged efficiency.

Deposition Below Yolo Bypass

72. Because the sediment storage space in the settling basin is being depleted, Cache Creek's heavy sediment load is carried into the Yolo Bypass unimpaired, thus affecting Yolo Bypass floodflow capacity. Also, additional sediment now flows downstream, further compounding the sediment deposition problems in navigation and flood control channels. To maintain the effectiveness of the Sacramento River and downstream San Francisco Bay system, deposited sediments have had to be continually dredged. Significant deposition problem areas presently evident below Yolo Bypass are the Sacramento River Deep Water Ship Channel and San Francisco Bay system. These problem areas are discussed in the following paragraphs and shown on plate C-20.

a. The Sacramento River Deep Water Ship Channel provides a 30-foot-deep channel for 43 miles from Suisun Bay to the Port of Sacramento. Portions of the channel are dredged an average of every 2

years. Based on 8 years of records, an average of 240,000 cubic yards of sediment has been dredged annually, costing over $300,000 per year.

b. The San Francisco Bay system contains a number of small bays, public ports, naval ports, and ship channels that are affected by the deposition of sediment carried into the bays from the Sacramento River and other areas. The Corps of Engineers in 1967 used sediment flow data collected by the U.S. Geological Survey to determine that 9.56 million cubic yards of sediment per year on the average flows into the system. Of this, about 8.13 million cubic yards per year is estimated to come from the Sacramento-San Joaquin Delta, principally from the Sacramento River Basin. Approximately 10 million cubic yards of Bay sediment is dredged annually by the Federal Government and private concerns from the Bay system. The majority of this material is disposed of in the Bay water at one of five disposal sites, and an estimated 1.4 million cubic yards is removed from the Bay annually by overboard dredged disposal.

73. The average annual dredging required from these critical problem areas is estimated at 11 million cubic yards, costing over $1 per cubic yard to remove. With a 50 percent sediment trap efficiency, 340 acre-feet would annually be trapped in the settling basin. With zero percent efficiency, no sediment would deposit in the basin, and 100 acre-feet would deposit in the Yolo Bypass adjacent to the basin. The remainder, 240 acre-feet, would continue downstream. Therefore, if no action is taken, an estimated 240 acre-feet (387,000 cubic yards) on the

average per year of sediment that was depositing in the settling basin will flow into the navigation system, and a portion will be deposited. This extra sediment amounts to about 5 percent of the sediment flow into the San Francisco Bay system from the Sacramento-San Joaquin Delta. Paragraphs 55, 56, and 57 of Section F of this appendix provide additional data on sediment deposition.

Municipal and Industrial Water Supply Needs

Lake County

74. While Clear Lake provides some municipal and industrial (M&I) water supply, ground water is the primary M&I water source in the vicinity of the lake. The Corps' authorized Lakeport Lake project, currently deferred due to lack of local assurances, would supplement the M&I water supply by providing an additional 8,400 acre-feet annually to the Lakeport area. However, Pomo Reservoir on Kelsey Creek, being studied by Lake County, would also supplement M&I water supply of the Clear Lake area.

Yolo County

75. The larger cities in Yolo County, such as Woodland, Davis, and Winters, obtain their entire water supply from ground water sources. Wells will undoubtedly continue to be used for M&I water supply in the future.

Irrigation Needs

Lake County

76. Although within Lake County, Clear Lake provides only a limited source of irrigation water for Lake County since Yolo County Flood Control and Water Conservation District owns the rights to much of the water stored in the lake. As set forth in the 1920 Gopcevic Decree, Yolo County has use of Clear Lake water for irrigation when the lake is between the stages of zero and 7.56 feet on the Rumsey gage at Lakeport. However, in utilizing this water, evaporation and other losses must be considered. Irrigation water supplies can be developed on the streams flowing into the lake. On Scotts Creek, the Corps' authorized Lakeport Lake project would provide 9,100 acre-feet annually of irrigation water. On Kelsey Creek, Lake County is studying construction of the Pomo Reservoir (Kelsey Reservoir) which will furnish irrigation water to the Big Valley area adjacent to Kelsey and Adobe Creeks.

77. The Bureau of Reclamation in its January 1969 English Ridge Unit feasibility report stated that future demand for irrigation water supply in the Clear Lake area would be 38,400 acre-feet annually. Of this, about 10,300 acre-feet would be required for the Big Valley area. However, the Bureau has indicated that the English Ridge Unit was economically infeasible at that time. Additional water could

potentially be stored in Clear Lake to meet Lake County demands. Studies of providing additional water to Lake, Yolo, and other nearby counties have recently been resumed by the Bureau of Reclamation.

Yolo County

78. Yolo is primarily an agricultural county, and water for agriculture is obtained from ground and surface water supplies. Clear Lake, Cache Creek, and the Sacramento River are the primary sources of surface water. Recent studies conducted by Clendenen and Associates, consulting engineers to Yolo County, indicate that with construction of Indian Valley Reservoir, the combined sources of surface and ground water are nearly sufficient to meet demands.

79. Accepting the existence of a minor overdraft of the ground water basin and that more water will be needed to irrigate land not presently used for agriculture, an additional source of supply is needed by Yolo County. Indian Valley Reservoir on North Fork Cache Creek provides an additional irrigation yield. Other possible sources of surface water include the West Sacramento Valley Canal, which was studied by the Bureau of Reclamation.

80. Studies were conducted by the Bureau of Reclamation in 1964 regarding irrigation water supply for the lower Cache Creek service area. This service area extends in a west to east direction from Rumsey

to the vicinity of Yolo and in a north to south direction from just north of Cache Creek to Putah Creek. The service area contains 160,800 acres of arable land. Of this area 52,058 acres are served by ground water sources providing about 222,000 acre-feet of water annually. Ground water safe yield is, however, estimated at 200,000 acre-feet. Total surface water source irrigation consumption from Cache Creek is about 96,000 acre-feet annually. Present firm yield is estimated at 45,000 acre-feet. With the development of Indian Valley Reservoir, Yolo County agricultural interests still indicate a need for future irrigation water supply.

Water Quality Problems

Clear Lake

81. Clear Lake has a significant water quality problem caused by excessive algal growths. Clear Lake is a eutrophic lake in that its rich nutrient content allows for massive algal blooms during certain times of the year. This interferes with one of its beneficial uses, which is recreation. The other major beneficial use of Clear Lake, that of an irrigation water supply for downstream users, is satisfactorily met for the crop types grown.

82. Nitrogen and phosphorus, the nutrients of major concern for algal growth in any water body, enter Clear Lake from stream inflows and overland runoff. Nutrients already in the lake play an important role in the seasonal algal growth cycles, since these nutrients are recycled when death and biological oxidation release them from their organic bonds.

83. The algal blooms of Clear Lake cause a "pea-soup" appearance. When wind-swept to the shoreline, the algae die, producing an unsightly appearance and an unpleasant odor which detrimentally affect recreation. The blue-green algae in the lake are the most obnoxious of all the algal family, since in addition to the above, they also release byproducts which are toxic in the higher concentrations. Certain blue-green algal species maintain their dominant position in Clear Lake because they possess gas vacuoles which allow them to remain in the lighted (euphotic) zone of the lake waters. Thus, they get the light needed for their growth, while shading other genera of algae such as the greens and diatoms.

84. The Clear Lake Algal Research Unit (CLARU) has rigorously studied the cause and control of algal blooms in Clear Lake. CLARU, supported by both the California Department of Water Resources and the Lake County Flood Control and Water Conservation District, has attempted to find a way to "tip the ecological balance" so that the growth of nonobnoxious green algae is favored over the growth of the obnoxious blue-green

algae. Algicides and artificial aeration have been tried to control the algae. The Oaks Arm has been artificially aerated to cause vertical mixing, which will keep both the green and the blue-green algae in the lighted euphotic zone where the faster growing green algae will use most of the dissolved nutrients for their growth. In the Upper Arm, which is too large for artificial aeration, algicide could be applied to inhibit fixation of atmospheric nitrogen by the blue-green algae. In the summer of 1973, artificial aeration was tried in the Lower Arm to control blue-green algal growth. In support of CLARU'S continuing efforts, the Department of Water Resources has recently conducted nutrient studies of Clear Lake.

Cache Creek

85. Currently, the water of Cache Creek, as it leaves lower Clear Lake, is a suitable quality to satisfy downstream beneficial uses. The major beneficial use of Cache Creek is irrigation water supply. Downstream of Clear Lake Dam, Bear Creek flows into Cache Creek and has a relatively high boron content, which detrimentally affects plant growth, with different plants having different sensitivities to it. Crops irrigated with lower Cache Creek waters have to be types insensitive to the usual boron concentrations present. Other quality parameters important in irrigation (total dissolved solids, chlorides, sodium absorption ratio, etc.) are satisfactory.

86. The other beneficial uses of Cache Creek, such as fishery and recreation, are satisfactorily met by the present qualities.

Fish and Wildlife Needs

87. In its report on "The Fish and Wildlife Resources of Anderson Marsh, Clear Lake, Lake County," dated January 1974, the California Department of Fish and Game concluded that Anderson Marsh and other associated wetlands are vital segments in Clear Lake's natural resource production, maintenance, and perpetuation. These resources will be further jeopardized if reduced or committed to nonresource use. The Department of Fish and Game has been attempting to preserve a wildlife area adjacent to the lake and proposes to purchase the Anderson Ranch, a portion of which is a natural marsh area, and develop a wildlife refuge.

88. Clear Lake is widely known as a good fishery for warmwater species of fish. The lake contains large numbers of largemouth bass, catfish, perch, crappie, bluegill, and sunfish. Many nongame species also inhabit the lake. Some of these rough fish, such as squawfish, suckers, splittail, and hitch, are stream spawners which ascend the streams from the lake to spawn during the spring. The young usually migrate to the

lake by early summer. For many years the hitch was considered one of the most important forage species for game fish in Clear Lake. However, currently the hitch is of relatively minor importance to game fish production or to the economy of the Clear Lake fishery.

89. The Clear Lake area is inhabitated by many species of wildlife including black-tail deer, ring-necked pheasant, mourning dove, valley quail, and rabbits. Waterfowl visit the area during migration periods. Fur-bearing animals include gray fox, bobcat, mink, raccoon, striped skunk, and muskrat. Many of these fur-bearers live along or in stream courses.

90. Cache Creek and its tributaries provide minor fisheries for smallmouth bass and white catfish. Other warmwater game species are present in limited numbers but contribute very little to the total sport catch. In addition, other nongame species, principally of the minnow family, squawfish, carp, and roach, are found throughout the drainage basin. Rainbow trout are present in the headwaters of North Fork of Cache Creek where water temperature is suitable year-round. In the Clear Lake Outlet Channel area, Cache Creek is considered by the State of California to be a Class II-very good waterway and Clear Lake a Class I-premium waterway for warmwater fisheries. The heavy sediment-carrying characteristic and intermittent nature of lower Cache Creek limit the production of game fish in the creek. Cache Creek is fed by many mineralized streams which further inhibit fishery productivity.

91. At the mouth of Cache Creek, the settling basin currently contains some lands that are not used for agriculture, thereby allowing maximum use for wildlife. However, that the amount of unused land has been continually diminishing concerns both the U.S. Fish and Wildlife Service and Department of Fish and Game.

General Recreation Needs

92. The Clear Lake area has been intensively developed for water-associated recreation. The lake has a shoreline of about 100 miles, of which 39 are presently developed for water-associated recreation facilities, including public and private beaches, wharfs, and lakeside residences.

93. Most of the desirable shoreline locations around Clear Lake have been developed with facilities; at Clear Lake Highlands, the shoreline is virtually saturated with recreation developments. Most of the shoreline areas having access to deep waters are developed to some extent. The largest areas of undeveloped shoreline exist southeast and northeast of Lakeport along shallow and marshy reaches of lakeshore where, during periods of low water, the lake recedes, leaving large

areas of lake bottom exposed. At the Clear Lake State Park, located at the base of Mount Konocti on Soda Bay, an area of public access to Clear Lake has been developed by dredging channels and lagoons for small boats. Over 100,000 recreation days of use annually are attributed to the State campgrounds. In the past few years additional facilities have been added for camping and boating.

94. A number of recreation facilities have been developed in the hills surrounding Clear Lake and along the tributary streams. However, the most popular resorts are those which can offer water-associated recreation. There is little flow during the summer in streams tributary to Clear Lake. Many Lake County interests have indicated a desire to develop additional recreation reservoirs on these streams to maintain flow during summer months.

95. Because the Clear Lake Water Company operates Clear Lake agricultural water supply, the lake is drawn down during late summer. In years of low inflow to the lake, lowering of the lake level is considered a detriment by recreation interests. Consequently, any operation of Clear Lake to stabilize its water surface would enhance recreation potential. Another detriment to recreation is blue-green algae blooms often occurring in Clear Lake and producing unsightly scums and foul odors.

96. At present, little recreation use is made of the main stem of Cache Creek or of its tributaries. The adjacent lands are used principally

for deer and quail hunting. Even this activity is somewhat limited because of limited access to the lands. In the past 5 years, whitewater boating on the North Fork of Cache Creek and Cache Creek has grown in popularity. Boating use in the lower reaches of North Fork Cache Creek and Cache Creek from their confluence to Rumsey is estimated to be between 2,000 and 5,000 recreation days annually. Construction of trails along Cache Creek would provide additional water-oriented recreation opportunity.

Improvements Desired

97. Lake and Yolo Counties and the State of California Reclamation Board have been actively interested in the feasibility study.

98. Improvements desired by local interests were expressed at the public meeting held in Woodland on 2 July 1969. These improvements vary from channel stabilization to multipurpose storage reservoirs. Local interests also desire to restrict the mining of aggregates from portions of Cache Creek. The Reclamation Board of the State of California, which maintains and operates the Sacramento River Flood Control Project, desires a long range solution to the settling basin problem to prevent

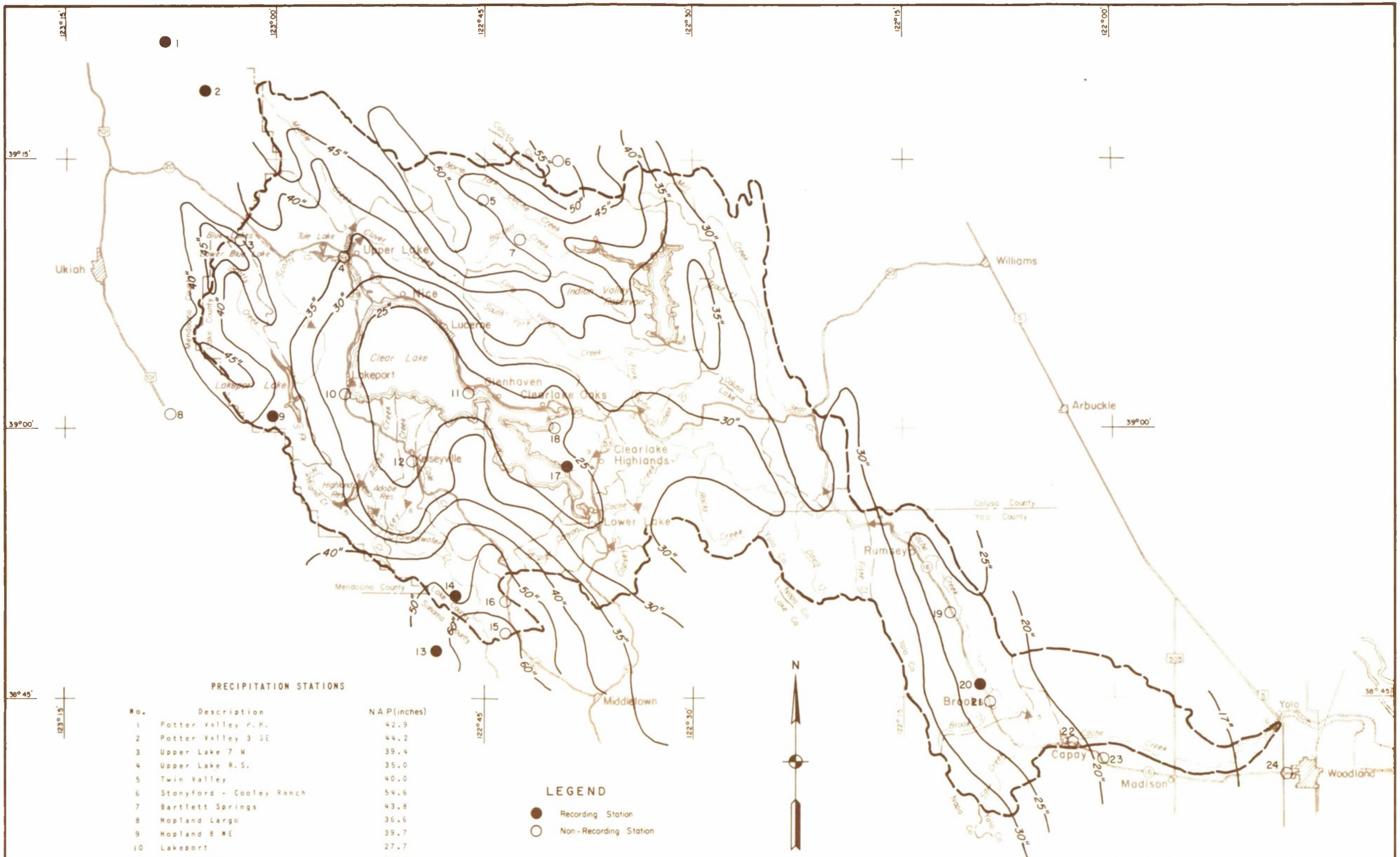
sediment deposition from reducing the flood-carrying capacity of the Yolo Bypass.

99. The two local water agencies of Lake and Yolo Counties indicate that additional irrigation water supply will be needed in both the upper and lower basins to supplement diminishing ground water supplies. Receding ground water is a significant problem throughout Big Valley south and west of Clear Lake and in the Sacramento Valley portion of the basin.

100. The water quality of Clear Lake has been deteriorating for many years. Also, the surface level of Clear Lake fluctuates throughout the year and from season to season because of irrigation releases during summer and fall and variation in inflow during winter and spring. Lake County officials would like to have the water quality improved and the lake level stabilized to enhance the recreation potential of the lake. However, any change in the present conditions of Clear Lake could have ecological implications requiring detailed study and evaluation. Also, Lake County officials would like to better control flooding of the lake perimeter.

101. Lake County indicated by letter dated 22 December 1975 that the recreation features shown at the public meeting, consisting of campgrounds and associated facilities and improved access along the outlet channel and to Garner Island, should not be included in the

project. The primary objection to recreation development as part of a Federal project was that it would compete with such development by local interests. Yolo County has voiced no objection to development of recreation facilities in lower Cache Creek Basin.



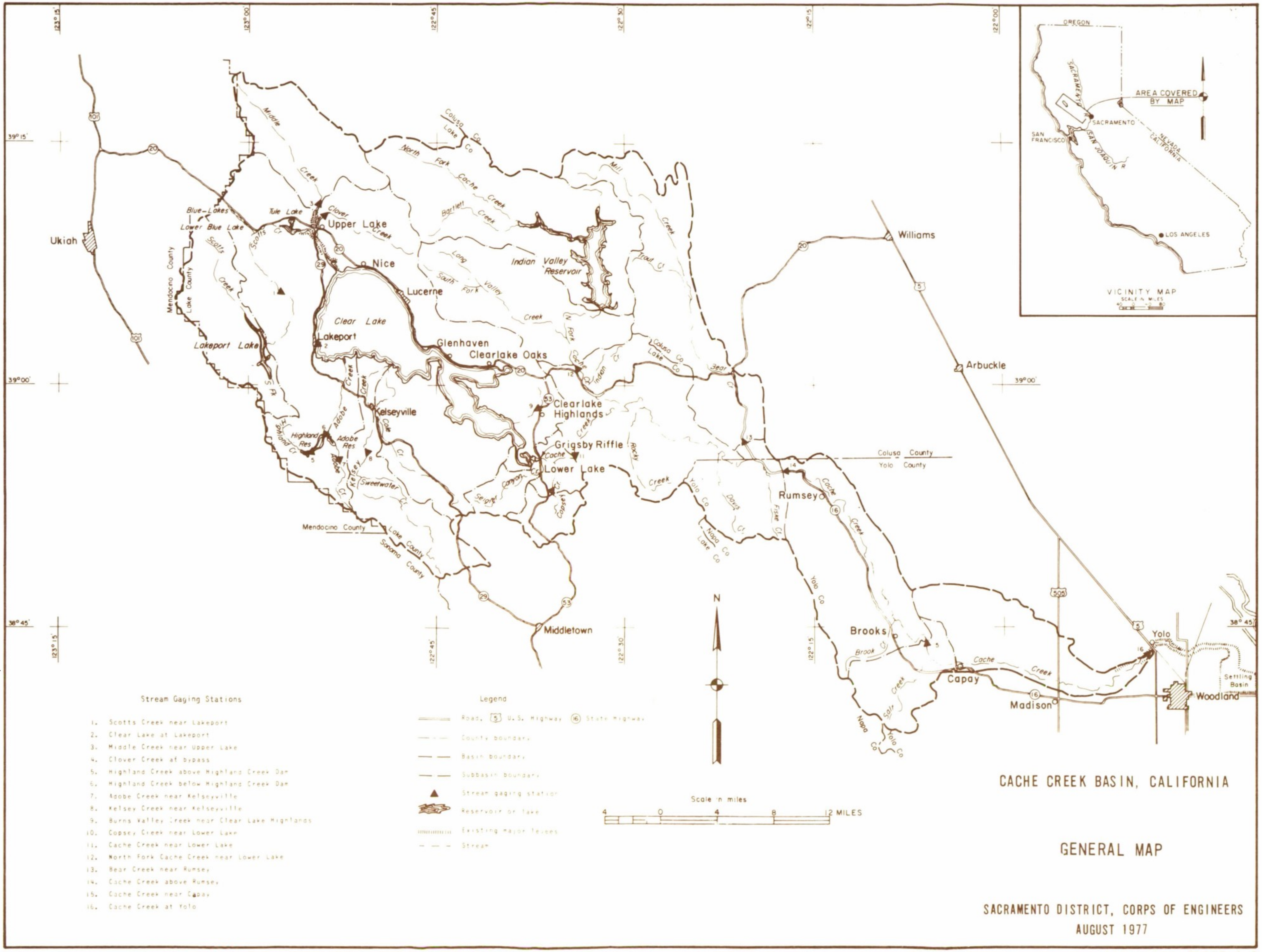
PRECIPITATION STATIONS

No.	Description	N A P (inches)
1	Potter Valley P.H.	42.9
2	Potter Valley 3 SE	44.2
3	Upper Lake 7 W	39.4
4	Upper Lake R.S.	35.0
5	Twin Valley	40.0
6	Stonyford - Cooley Ranch	54.6
7	Bartlett Springs	43.8
8	Hopland Largo	36.6
9	Hopland 8 NE	39.7
10	Lakeport	27.7
11	Kono Tayee	23.0
12	Kelseyville	23.5
13	The Geysers	54.0
14	Mahnke	47.7
15	Cobb	60.5
16	Hobergs	54.0
17	Clearlake Highlands	23.6
18	Sulphur Bnks.	24.6
19	Guinda	20.9
20	Brook Farnham Ranch	20.0
21	Brooks	20.5
22	Capay	22.1
23	Esparto	17.5
24	Woodland IWNW	16.9

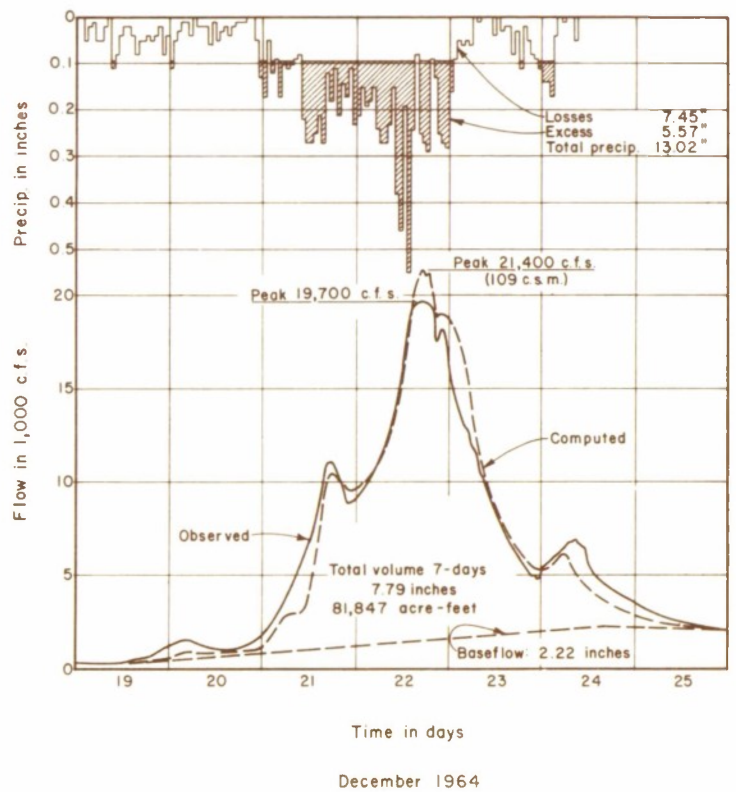
CACHE CREEK BASIN, CALIFORNIA

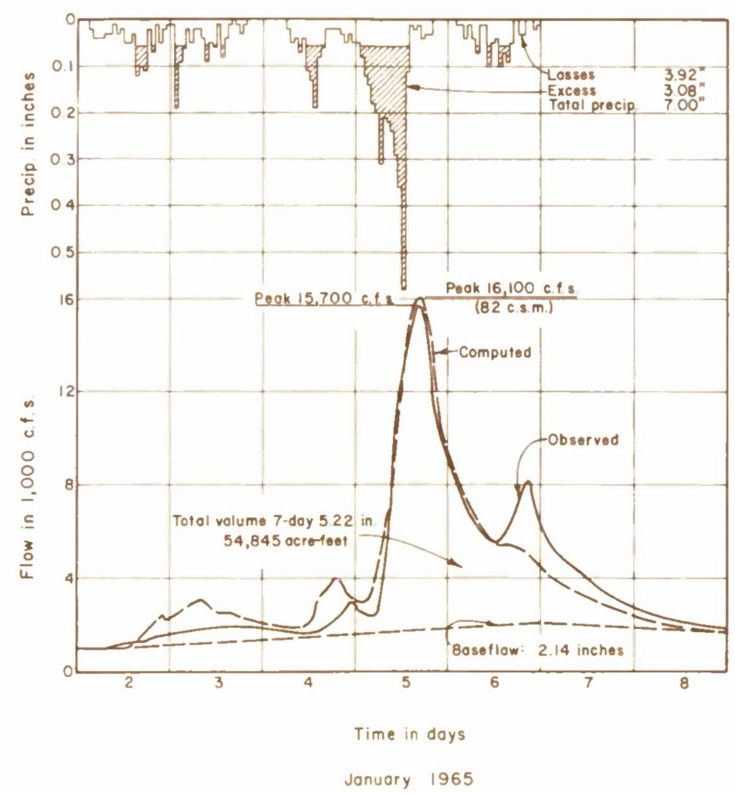
NORMAL ANNUAL PRECIPITATION MAP

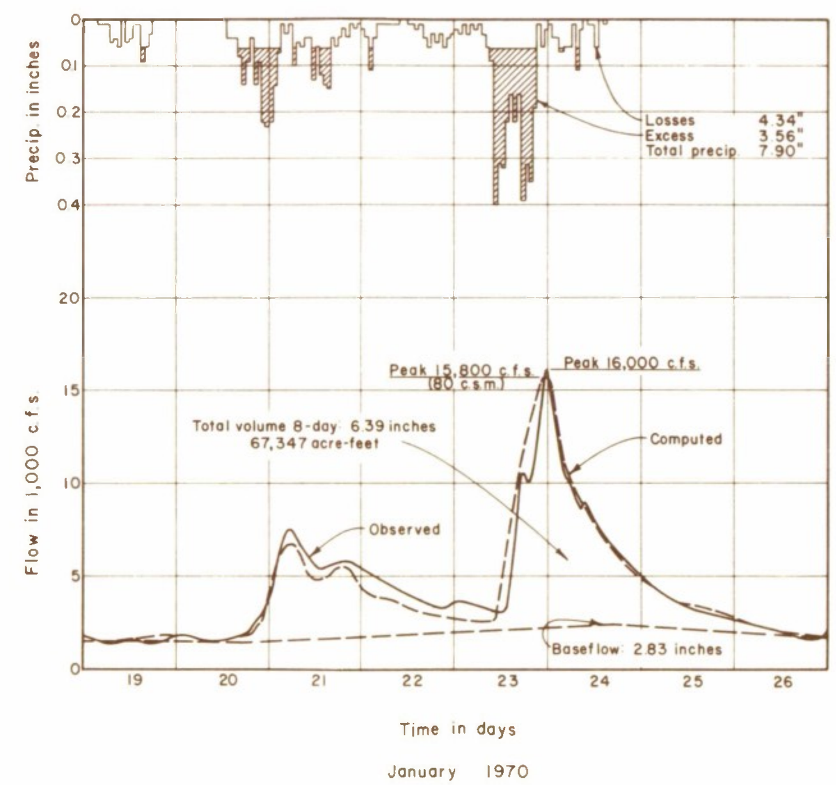
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



APPENDIX I PLATE C-2





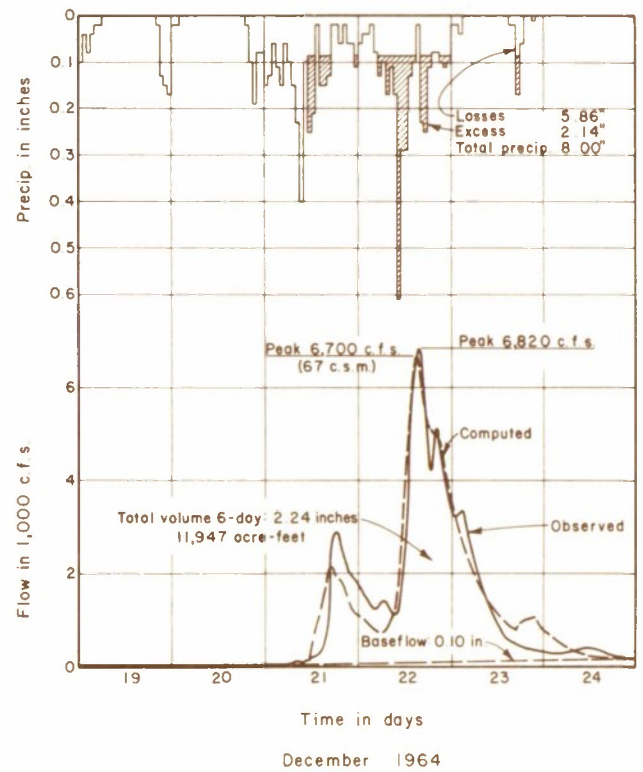


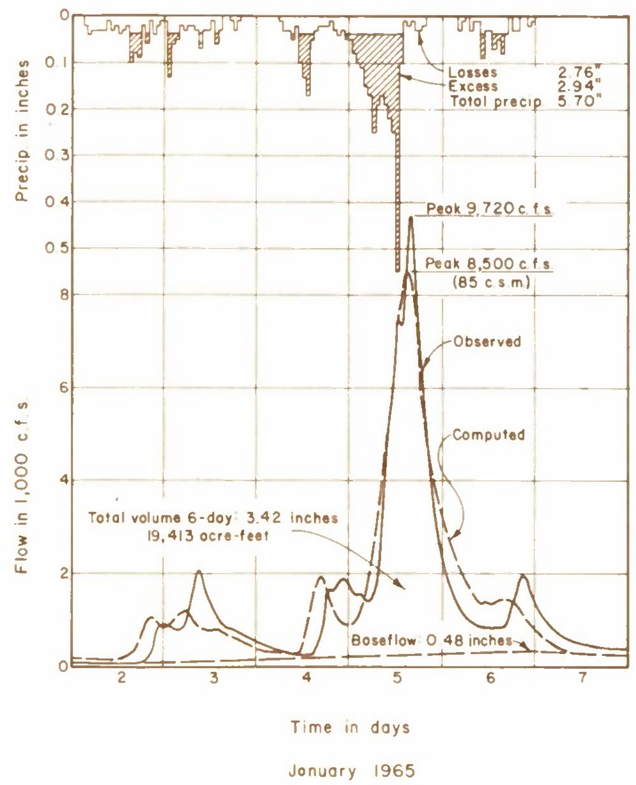
Drainage Area: 197.0 sq. mi.

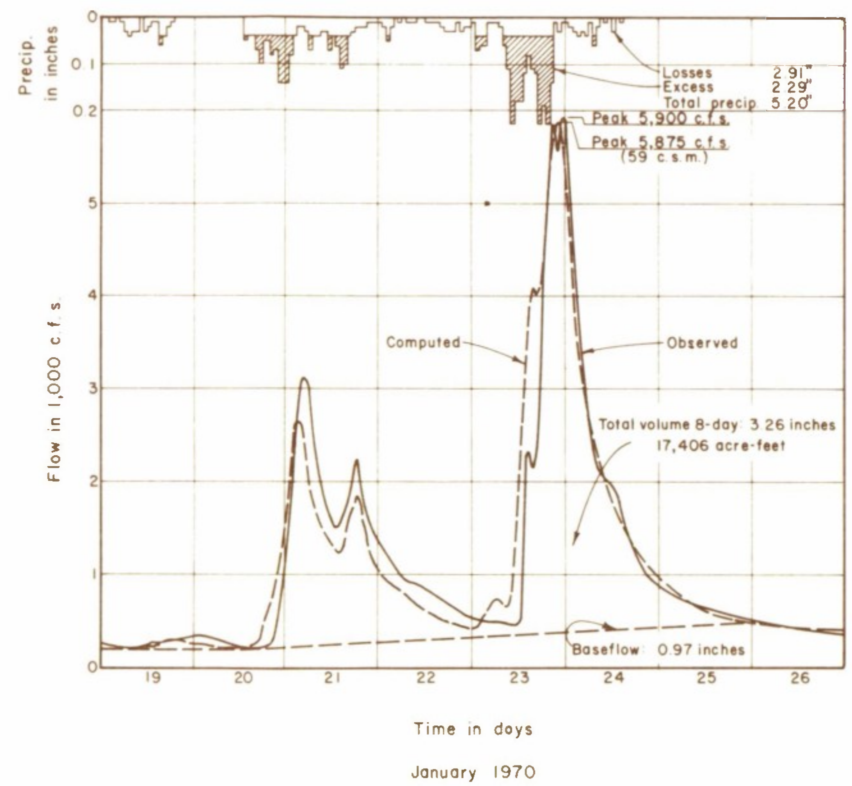
CACHE CREEK BASIN, CALIFORNIA

FLOOD HYDROGRAPHS
NORTH FORK CACHE CREEK
NEAR LOWER LAKE
INDEX POINT-5

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977





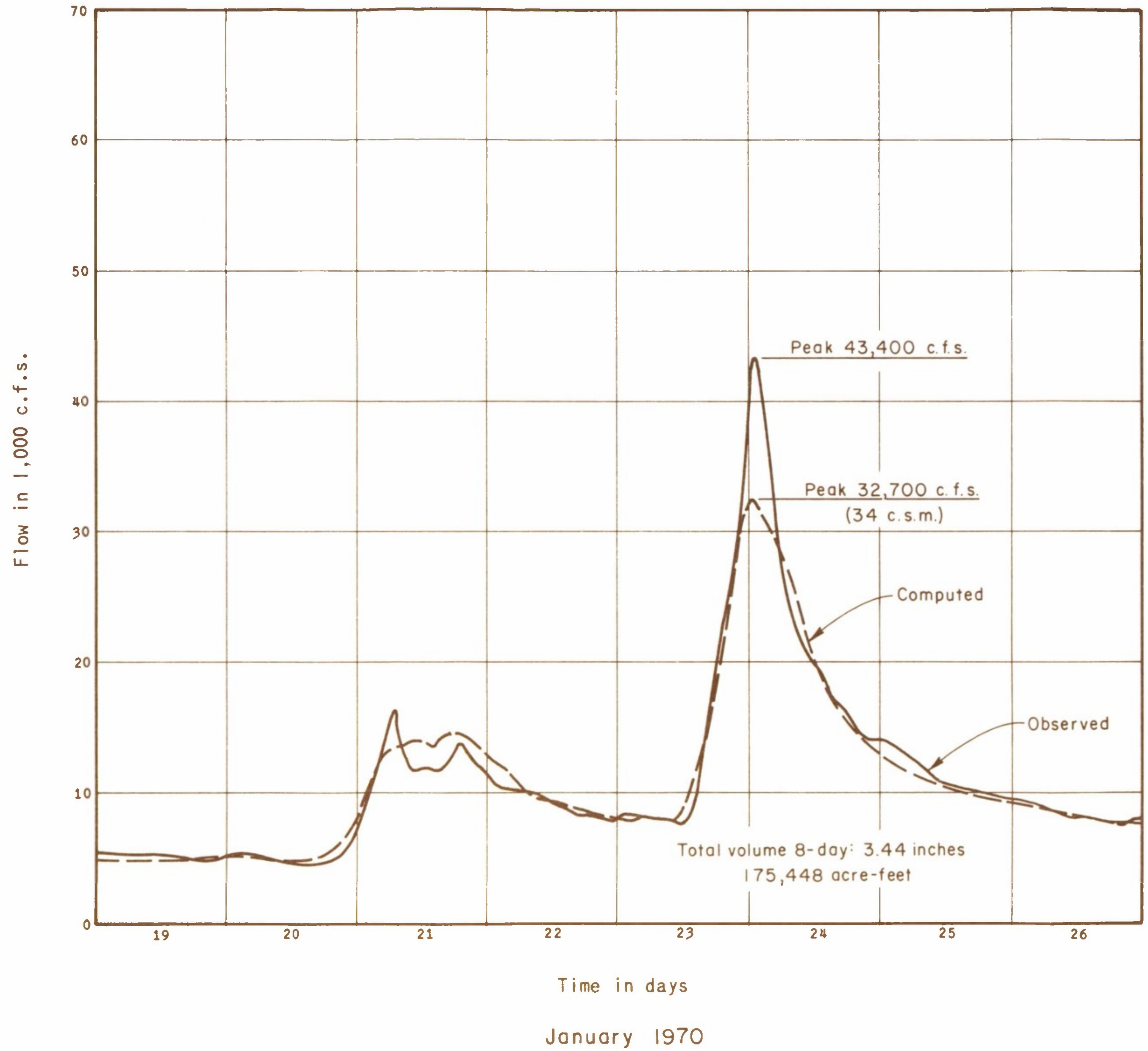


Drainage area: 100 sq mi

CACHE CREEK BASIN, CALIFORNIA

FLOOD HYDROGRAPHS
BEAR CREEK NEAR RUMSEY
INDEX POINT-6

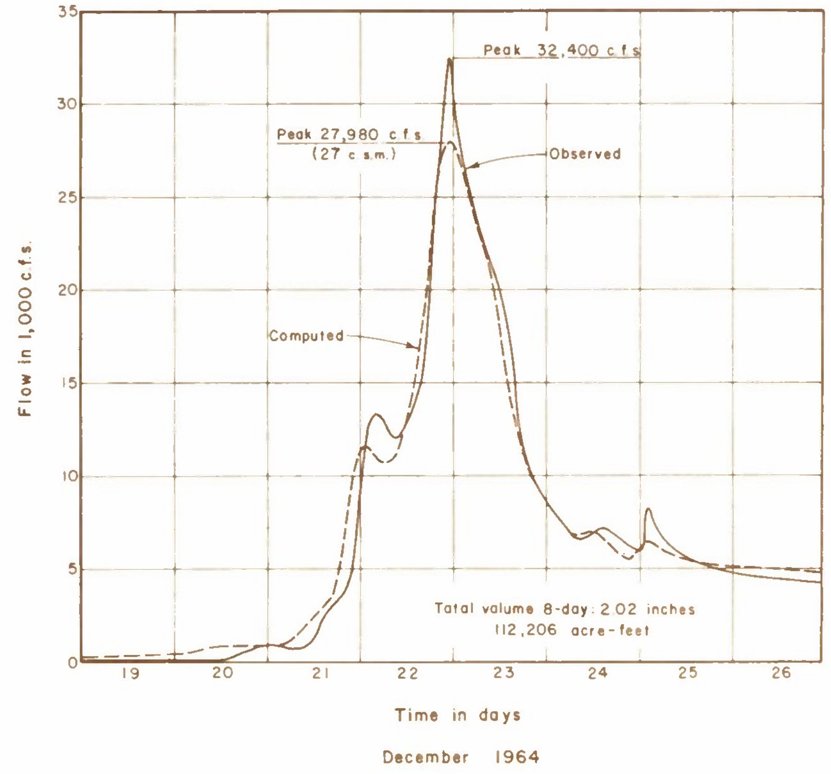
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

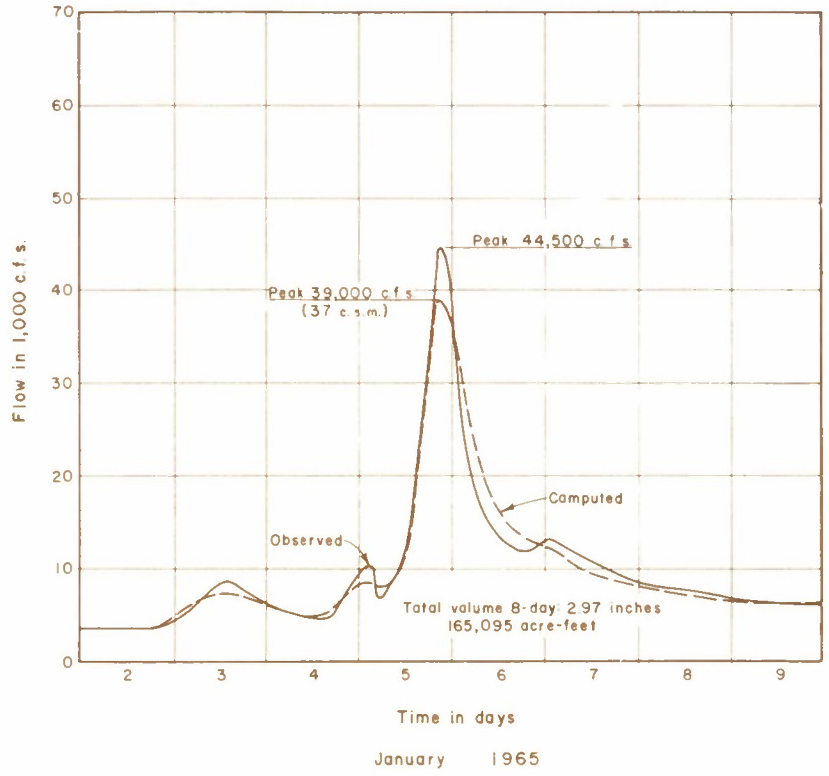


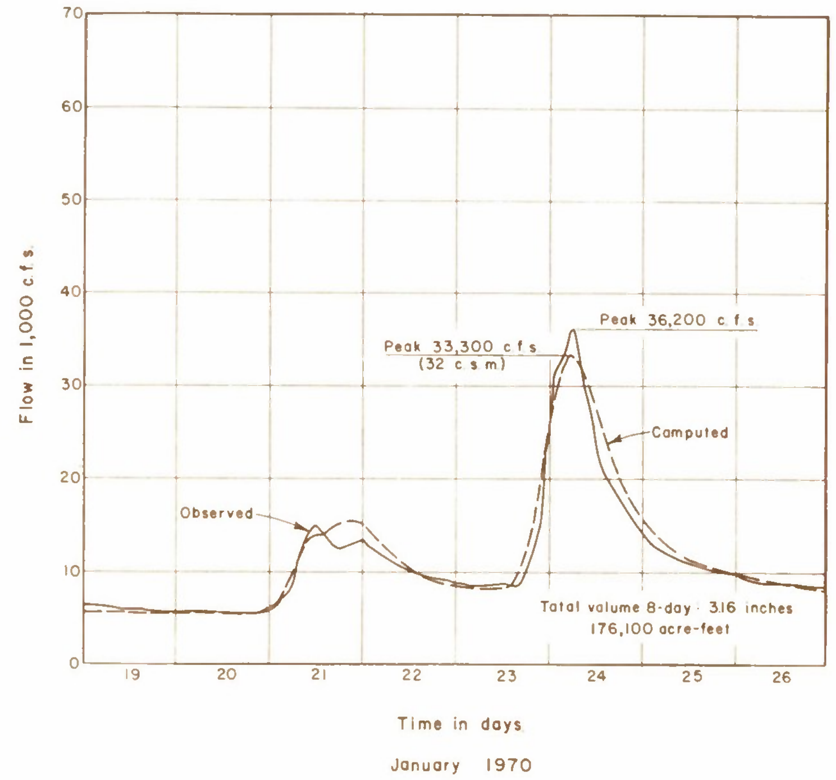
CACHE CREEK BASIN, CALIFORNIA

FLOOD HYDROGRAPHS
CACHE CREEK ABOVE RUMSEY
INDEX POINT-7

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977





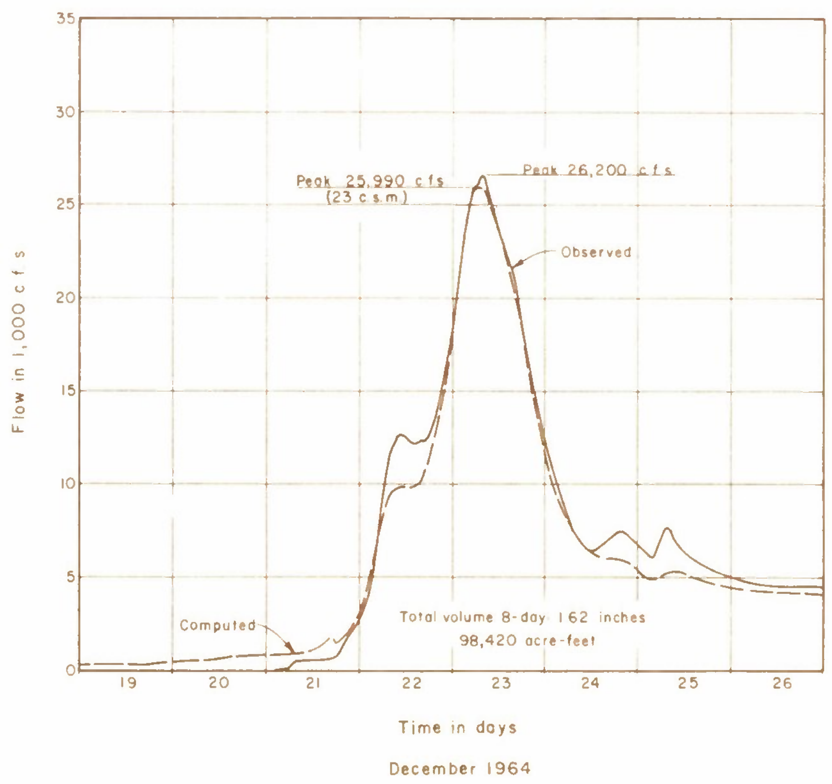


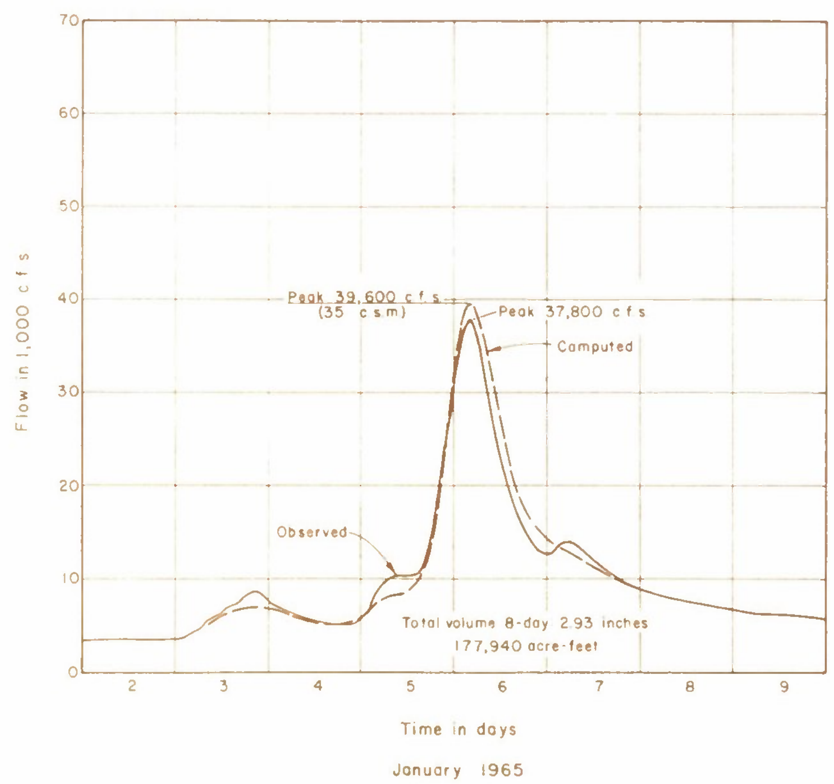
Drainage Area: 1044 sq. mi.

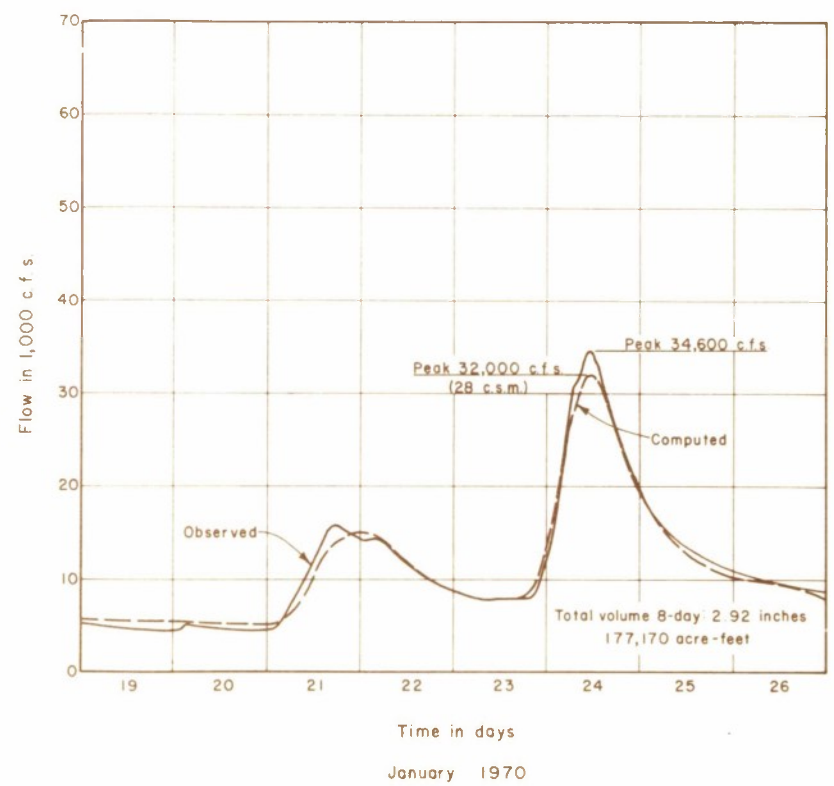
CACHE CREEK BASIN, CALIFORNIA

FLOOD HYDROGRAPHS
CACHE CREEK NEAR CAPAY
INDEX POINT-8

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977





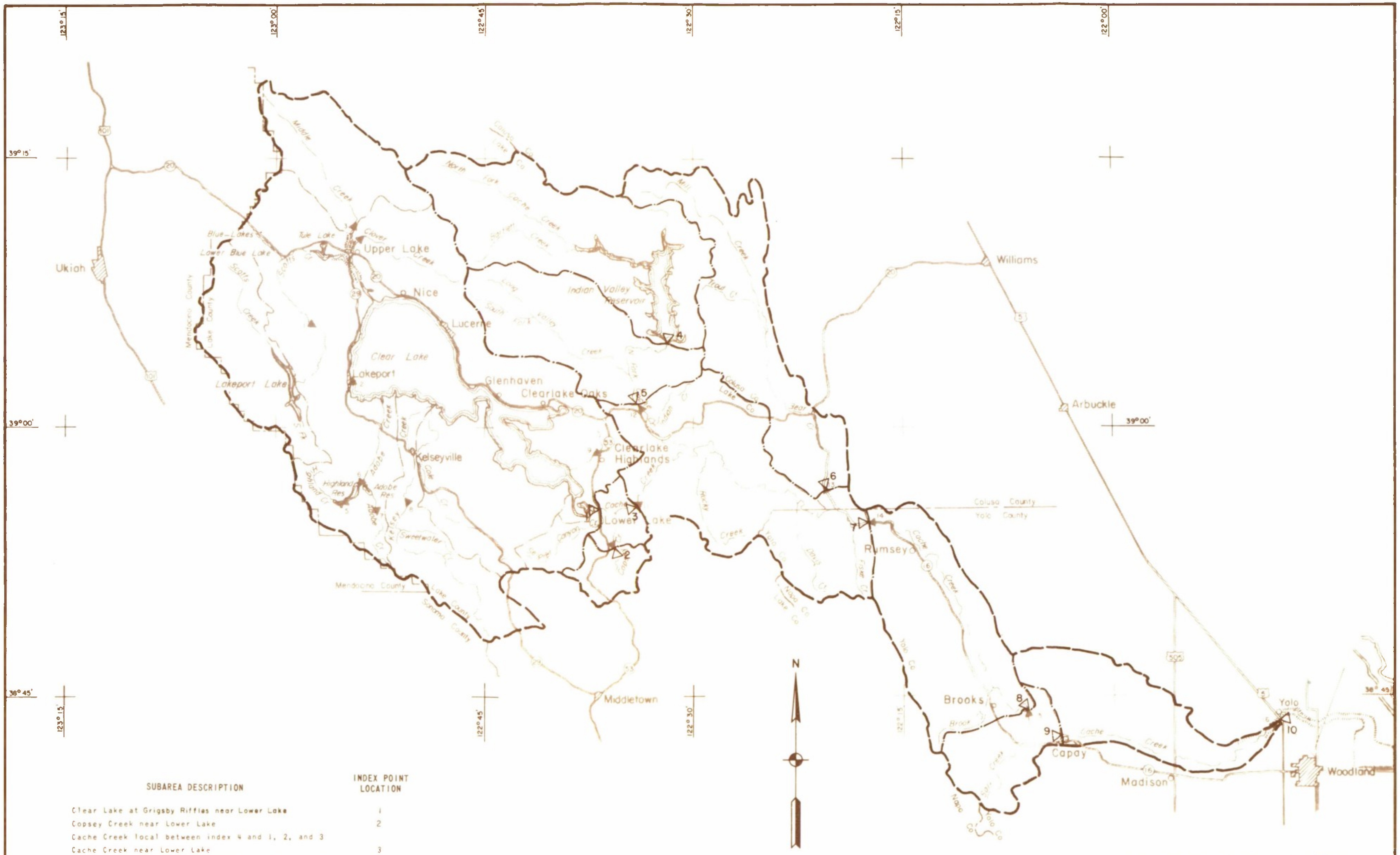


Drainage Area 1139 sq mi

CACHE CREEK BASIN, CALIFORNIA

FLOOD HYDROGRAPHS
CACHE CREEK AT YOLO
INDEX POINT-10

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



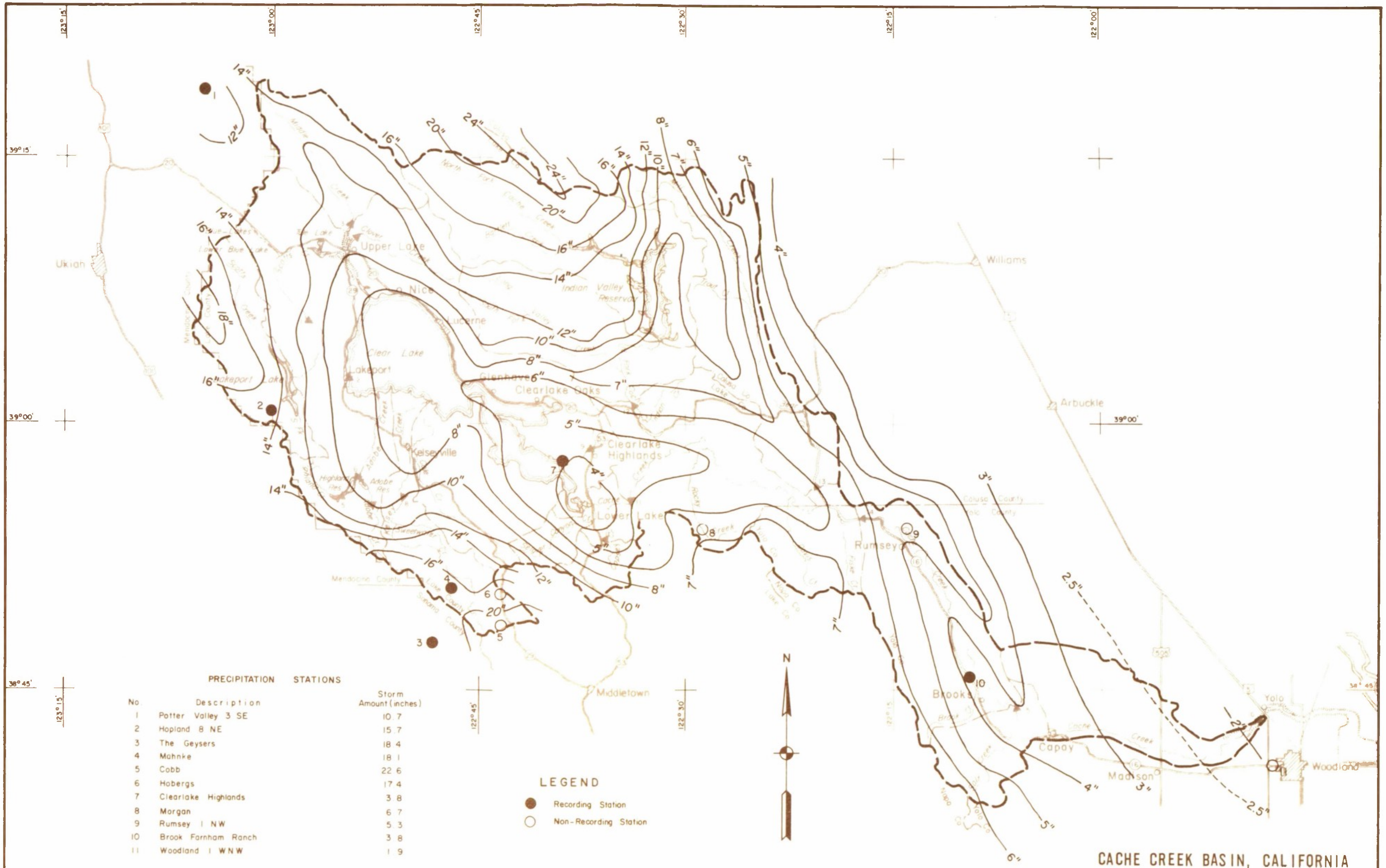
NOTE: For legend see Plate C-2

SUBAREA DESCRIPTION	INDEX POINT LOCATION
Clear Lake at Grigsby Riffles near Lower Lake	1
Copsey Creek near Lower Lake	2
Cache Creek local between index 4 and 1, 2, and 3	
Cache Creek near Lower Lake	3
North Fork Cache Creek at Indian Valley Reservoir	4
North Fork Cache Creek local between 4 and 3	
North Fork Cache Creek near Lower Lake	5
Bear Creek near Rumsey	6
Cache Creek local between index 6 and 5, 4, and 3	
Cache Creek above Rumsey	7
Cache Creek local between index 7 and 6	
Cache Creek near Capay	8
Cache Creek local between index 8 and 7	9
Cache Creek local between index 9 and 8	
Cache Creek at Yolo	10

CACHE CREEK BASIN, CALIFORNIA

SUBAREA MAP

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



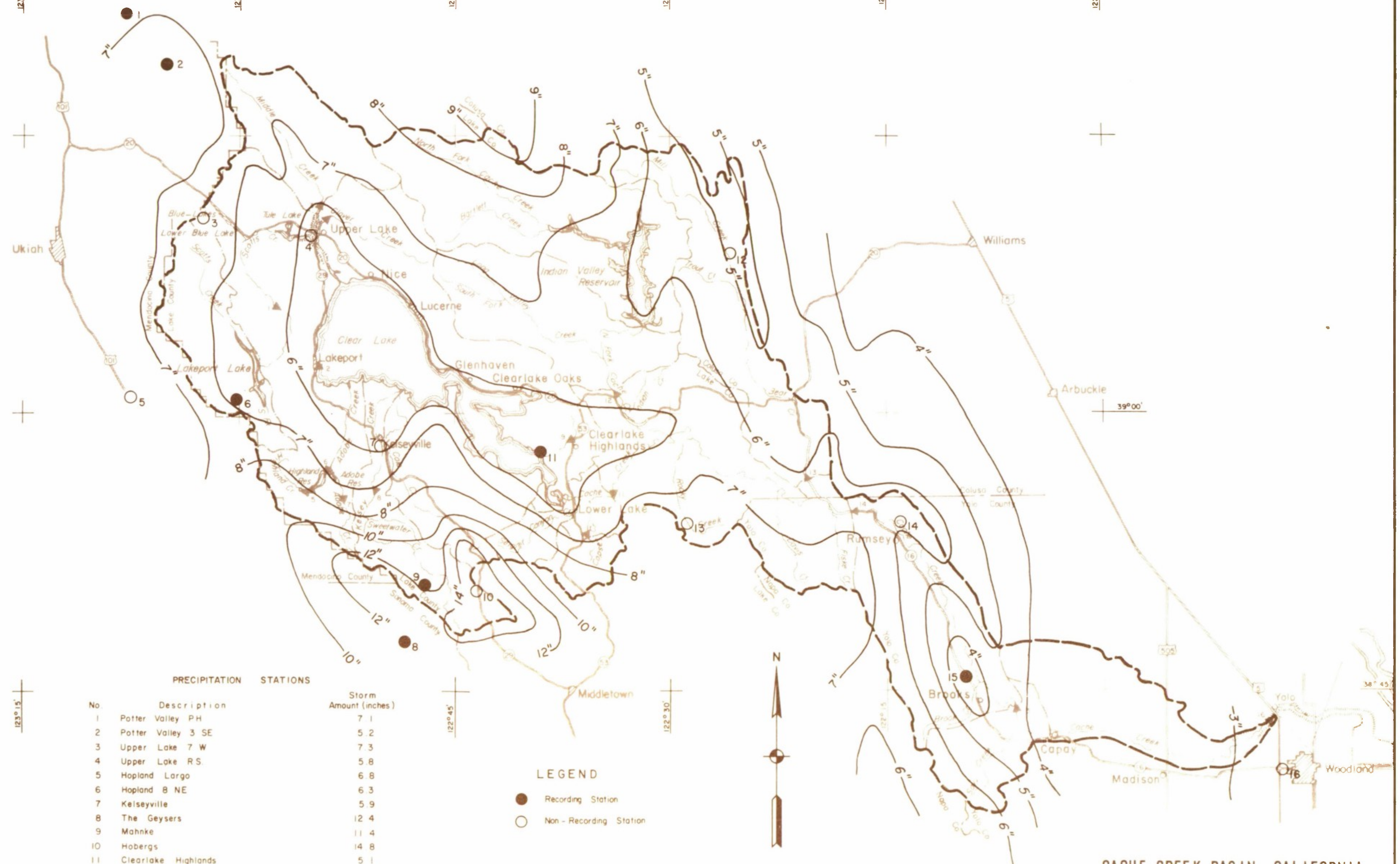
PRECIPITATION STATIONS

No	Description	Storm Amount (inches)
1	Potter Valley 3 SE	10 7
2	Hopland 8 NE	15 7
3	The Geysers	18 4
4	Mahnke	18 1
5	Cobb	22 6
6	Hobergs	17 4
7	Clearlake Highlands	3 8
8	Morgan	6 7
9	Rumsey 1 NW	5 3
10	Brook Farnham Ranch	3 8
11	Woodland 1 WNW	1 9

CACHE CREEK BASIN, CALIFORNIA

DECEMBER 1964 STORM
ISOHYETAL MAP

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



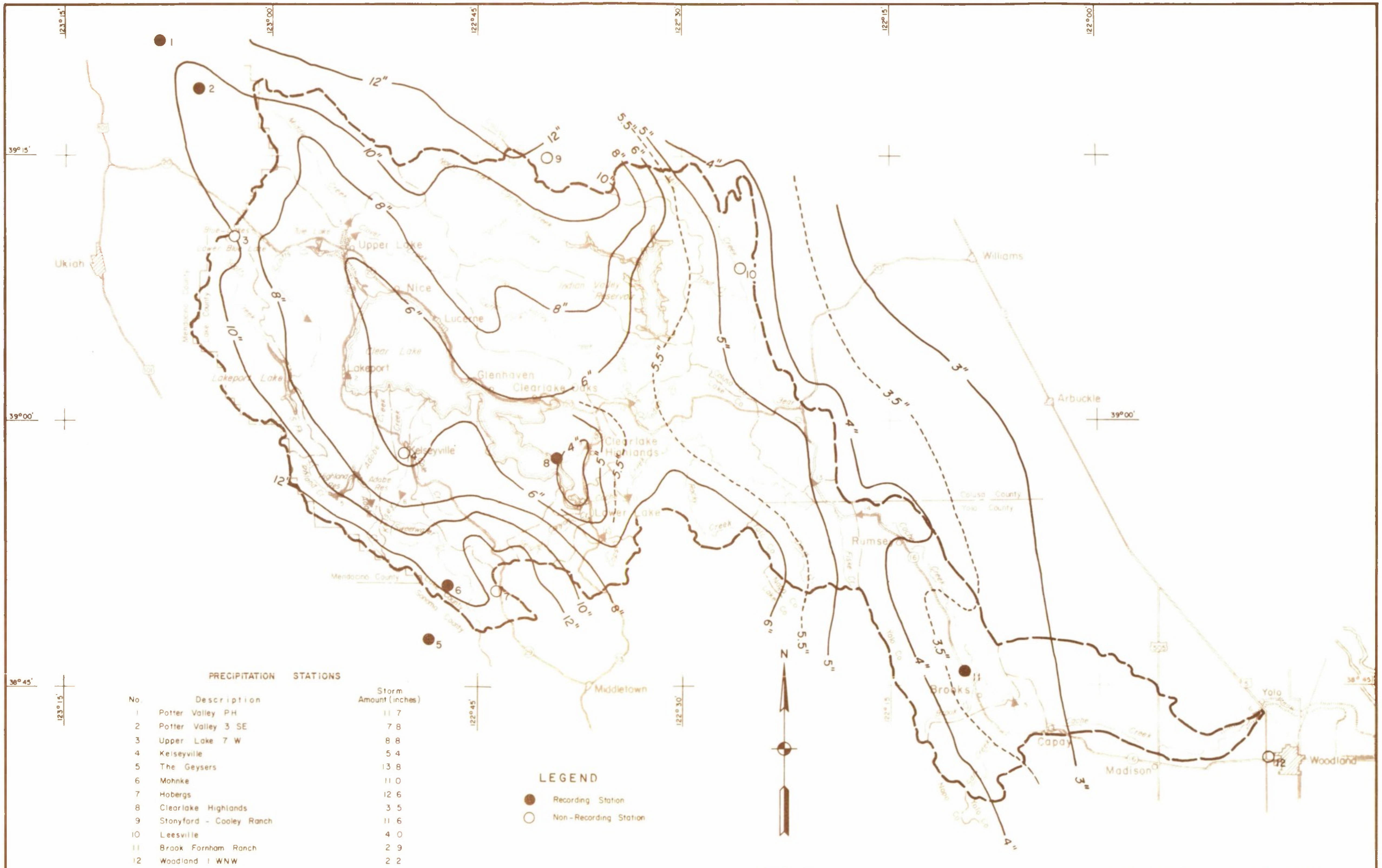
PRECIPITATION STATIONS

No	Description	Storm Amount (inches)
1	Potter Valley PH	7.1
2	Potter Valley 3 SE	5.2
3	Upper Lake 7 W	7.3
4	Upper Lake R.S.	5.8
5	Hopland Largo	6.8
6	Hopland 8 NE	6.3
7	Kelseyville	5.9
8	The Geysers	12.4
9	Mahnke	11.4
10	Hobergs	14.8
11	Clearlake Highlands	5.1
12	Leesville	4.7
13	Morgan	7.1
14	Rumsey 1 N.W.	6.1
15	Brook Farnham Ranch	3.0
16	Woodland 1 WNW	2.3

CACHE CREEK BASIN, CALIFORNIA

JANUARY 1965 STORM
ISOHYETAL MAP

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



PRECIPITATION STATIONS

No.	Description	Storm Amount (inches)
1	Potter Valley PH	11.7
2	Potter Valley 3 SE	7.8
3	Upper Lake 7 W	8.8
4	Kelseyville	5.4
5	The Geysers	13.8
6	Mohnke	11.0
7	Hobergs	12.6
8	Clearlake Highlands	3.5
9	Stonyford - Cooley Ranch	11.6
10	Leesville	4.0
11	Brook Fornham Ranch	2.9
12	Woodland 1 WNW	2.2

LEGEND

● Recording Station

○ Non-Recording Station

Scale in miles

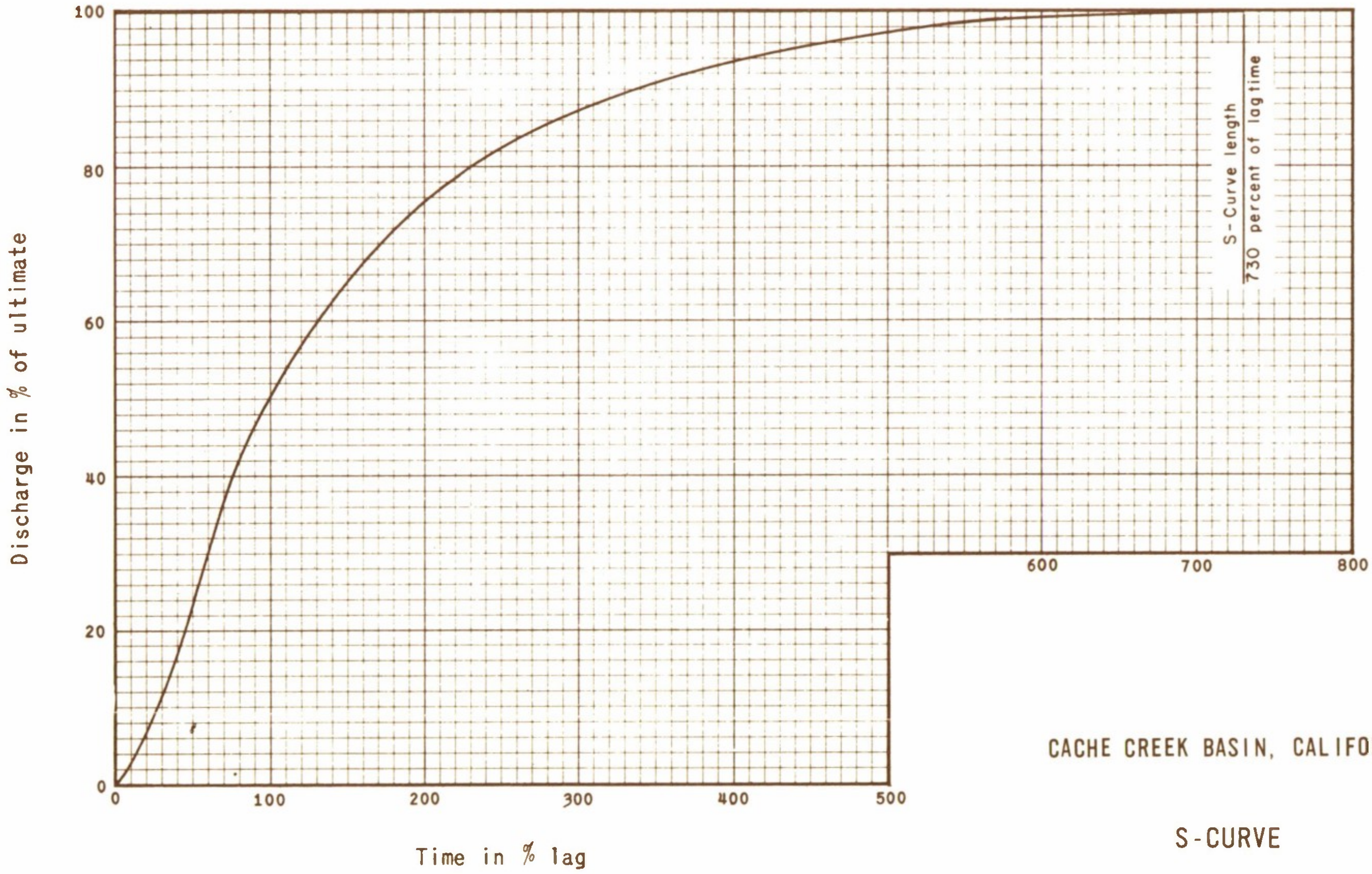
4 0 4 8 12 MILES

CACHE CREEK BASIN, CALIFORNIA

JANUARY 1970 STORM
ISOHYETAL MAP

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

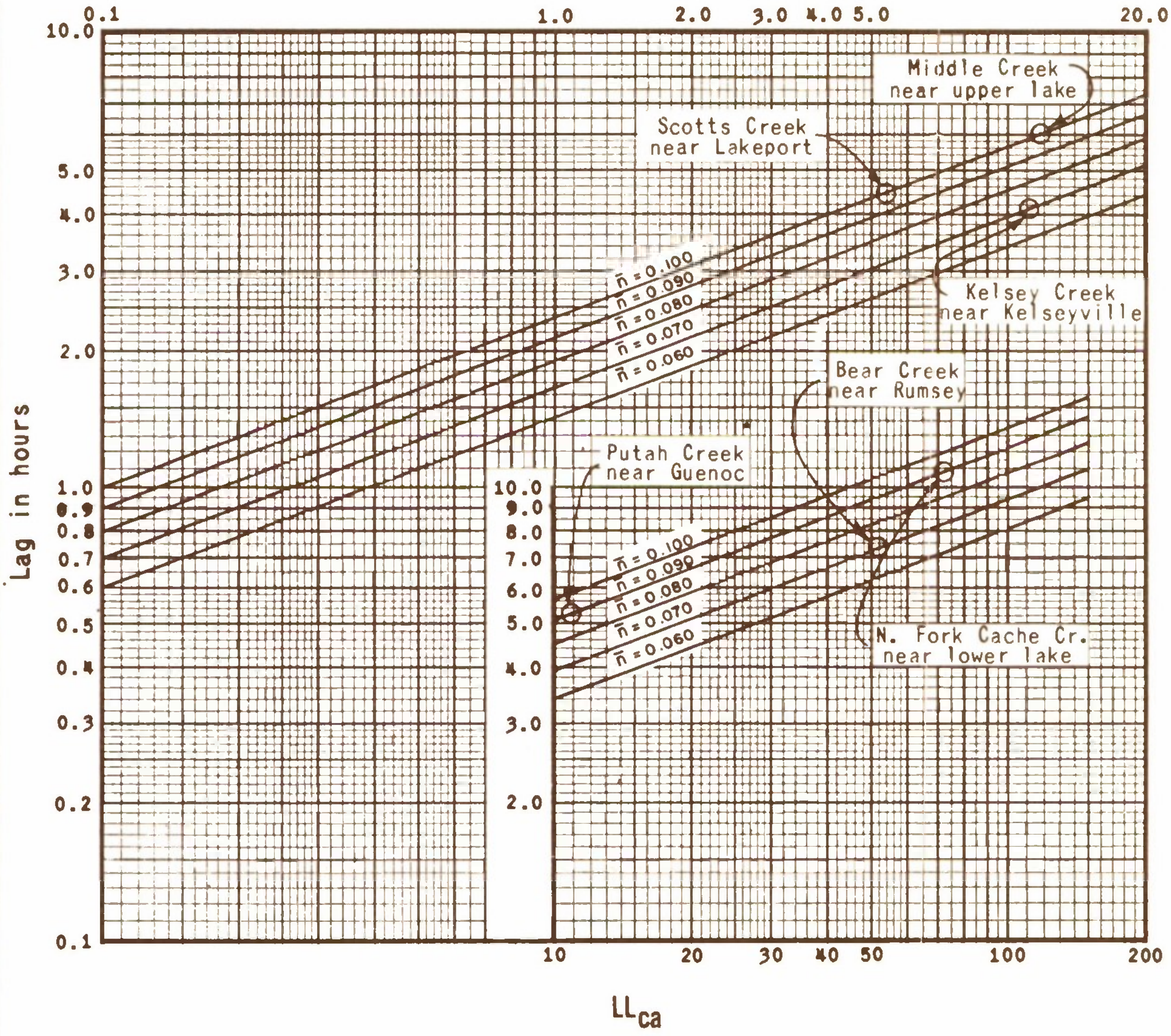
AUGUST 1977



CACHE CREEK BASIN, CALIFORNIA

S-CURVE

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



TERMINOLOGY

L - Length of longest watercourse.

L_{ca} - Length along longest watercourse, measured upstream to point opposite center of area.

S - Overall slope of longest watercourse between headwater and collection point.

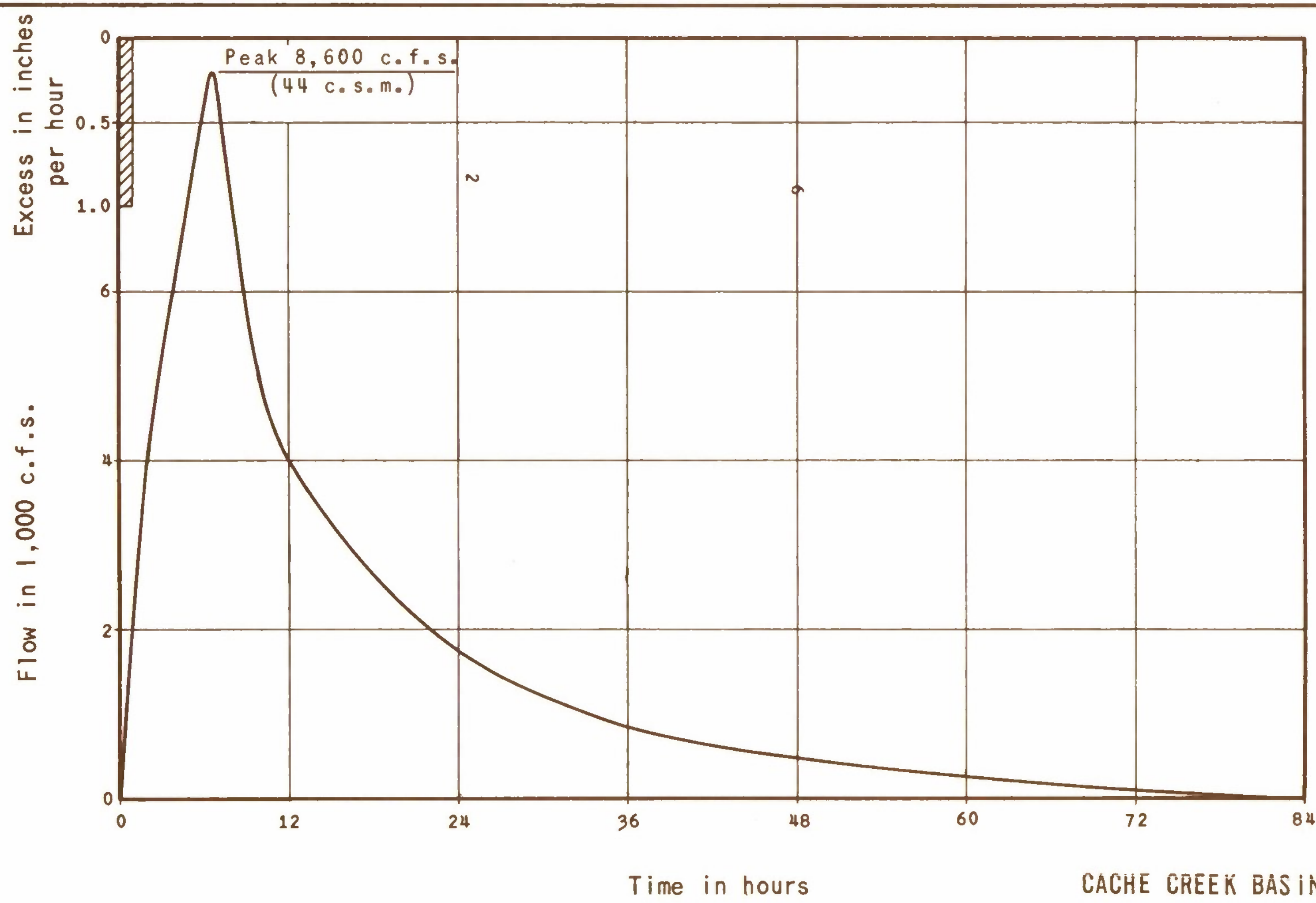
Lag - Elapsed time from beginning of rain excess to instant that summation hydrograph reaches 50% of ultimate discharge.

$\bar{n}$ - Basin factor representing basin shape, drainage pattern, and roughness of the stream beds.

CACHE CREEK BASIN, CALIFORNIA

LAG RELATIONSHIPS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

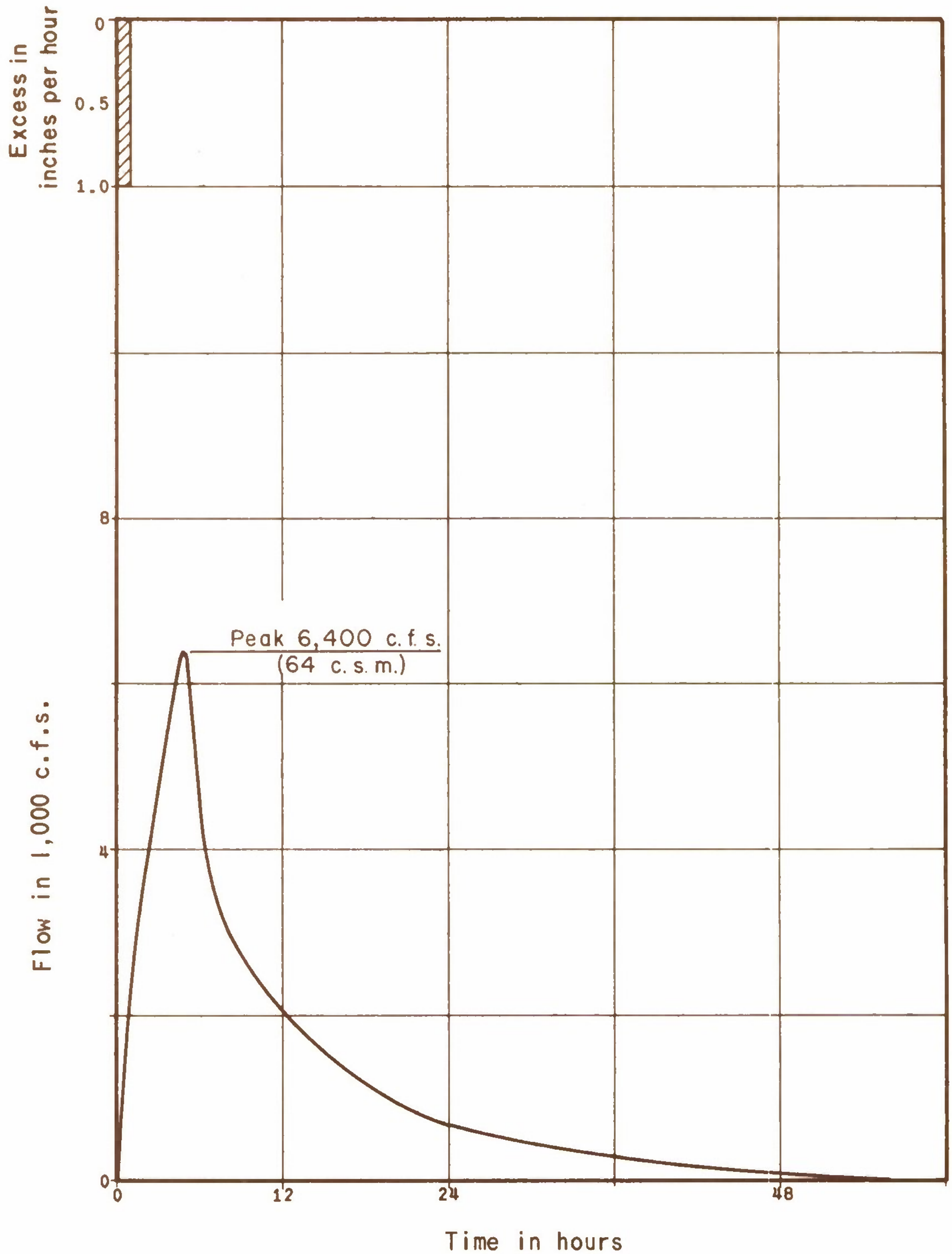


DRAINAGE AREA	197.0 sq. mi.
$LL_{ca}/S^{.5}$	73.33
$\bar{n}$	0.090
Lag	11.05 hours
Peak	8,600 c.f.s.
Volume	127,131 1-hr. c.f.s.

CACHE CREEK BASIN, CALIFORNIA

UNIT HYDROGRAPH
NORTH FORK CACHE CREEK
NEAR LOWER LAKE
INDEX POINT-5

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

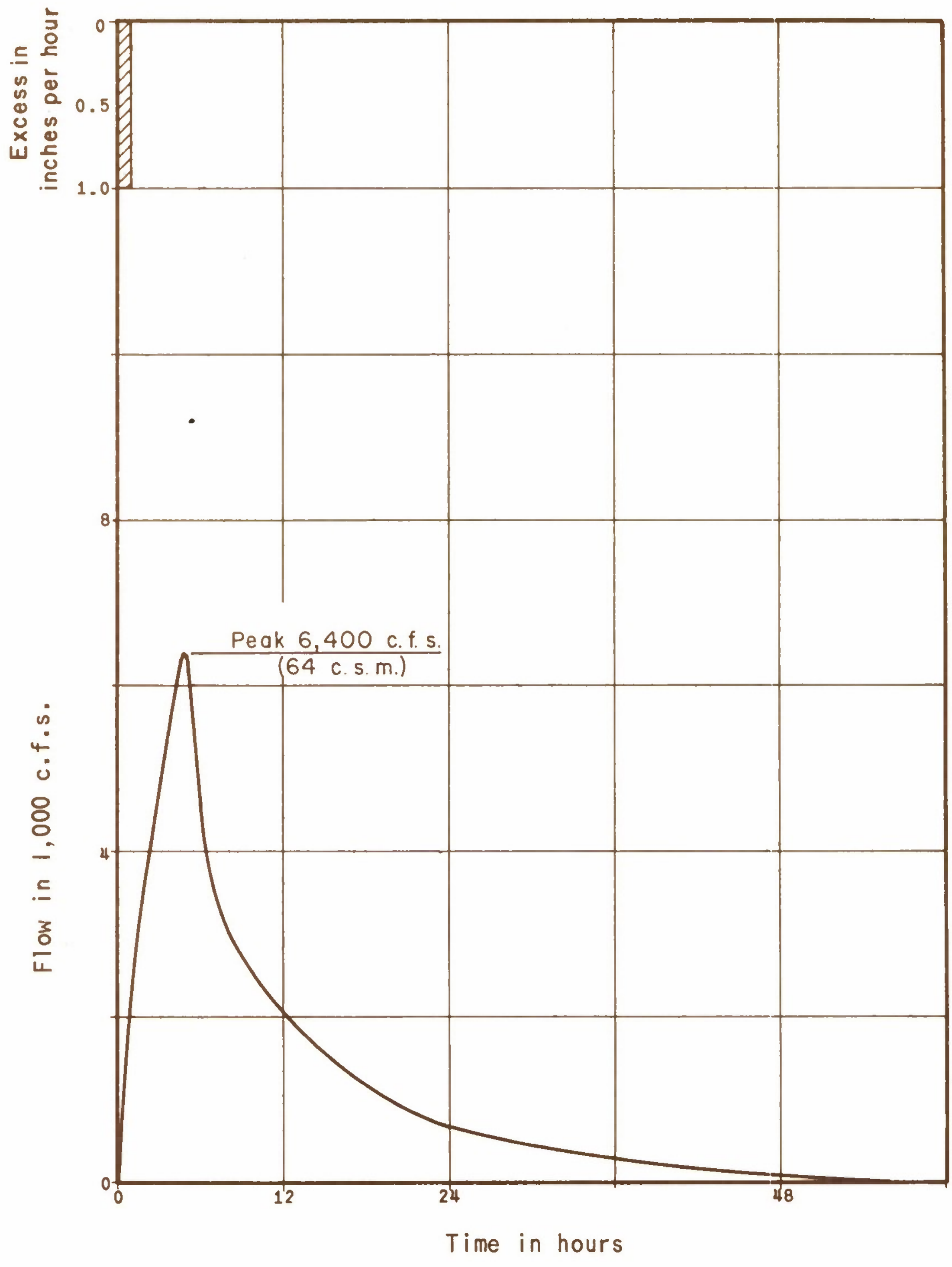


DRAINAGE AREA	100.0 sq. mi.
$LL_{ca}/S^{.5}$	50.52
$\bar{n}$	0.070
Lag	7.46 hours
Peak	6,400 c.f.s.
Volume	64,533 1-hr. c.f.s.

CACHE CREEK BASIN, CALIFORNIA

UNIT HYDROGRAPH
BEAR CREEK NEAR RUMSEY GAGE
INDEX POINT-6

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

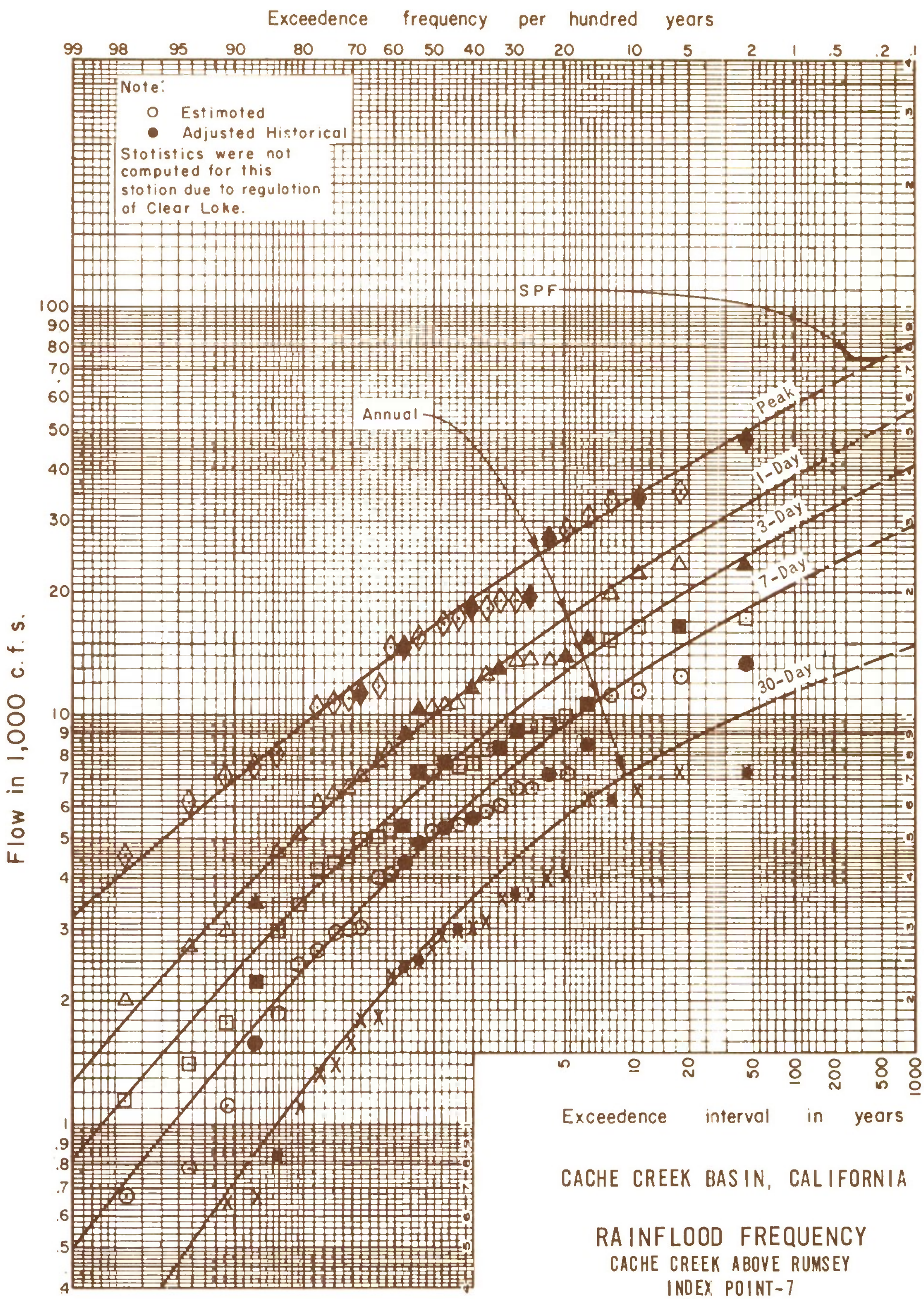


DRAINAGE AREA	100.0 sq. mi.
$LL_{ca}/S^{.5}$	50.52
$\bar{n}$	0.070
Lag	7.46 hours
Peak	6,400 c.f.s.
Volume	64,533 1-hr. c.f.s.

CACHE CREEK BASIN, CALIFORNIA

UNIT HYDROGRAPH
BEAR CREEK NEAR RUMSEY GAGE
INDEX POINT-6

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



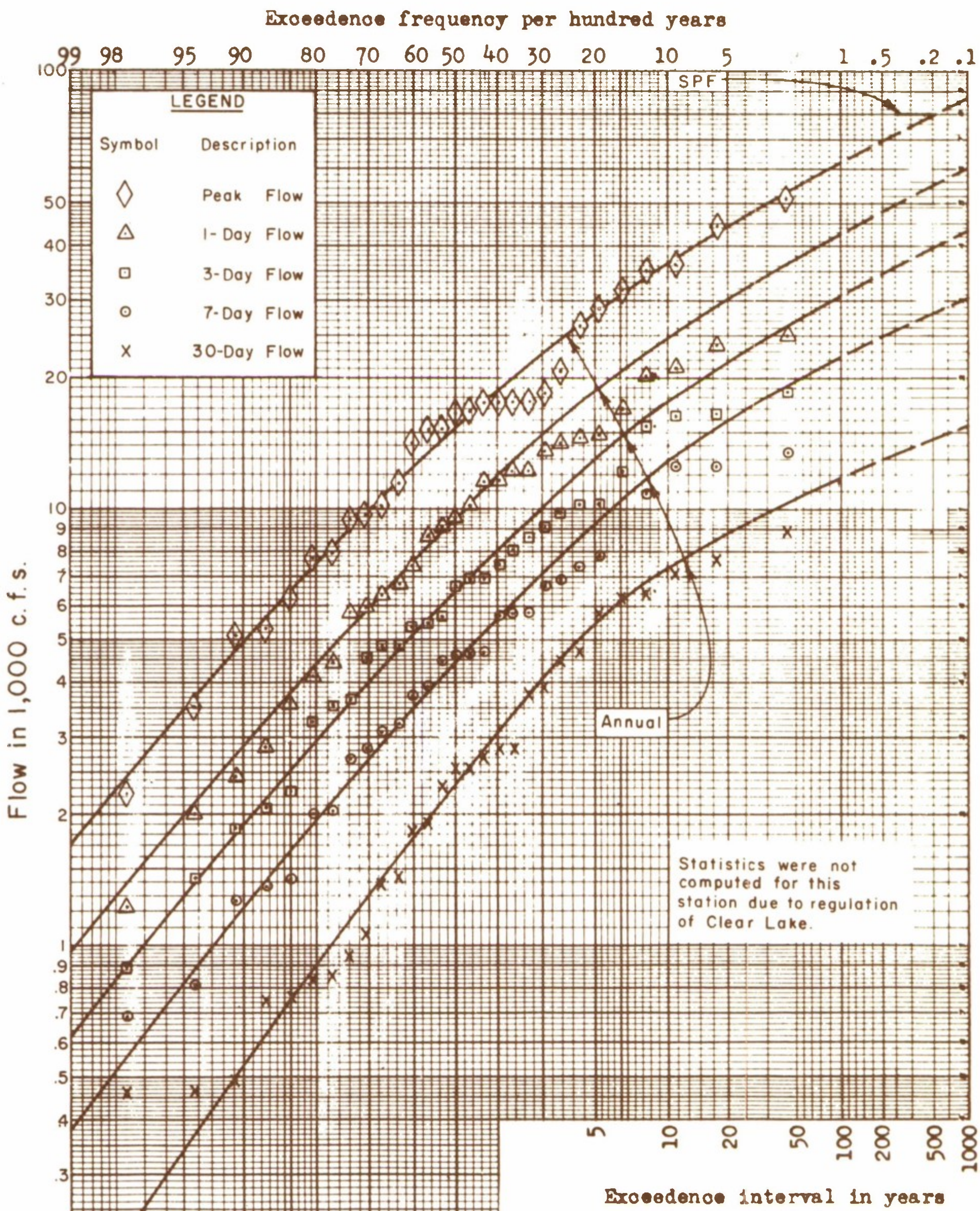
CACHE CREEK BASIN, CALIFORNIA

RAINFLOOD FREQUENCY
CACHE CREEK ABOVE RUMSEY
INDEX POINT-7

DA: 955 sq. mi.

Period
1943-1971

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



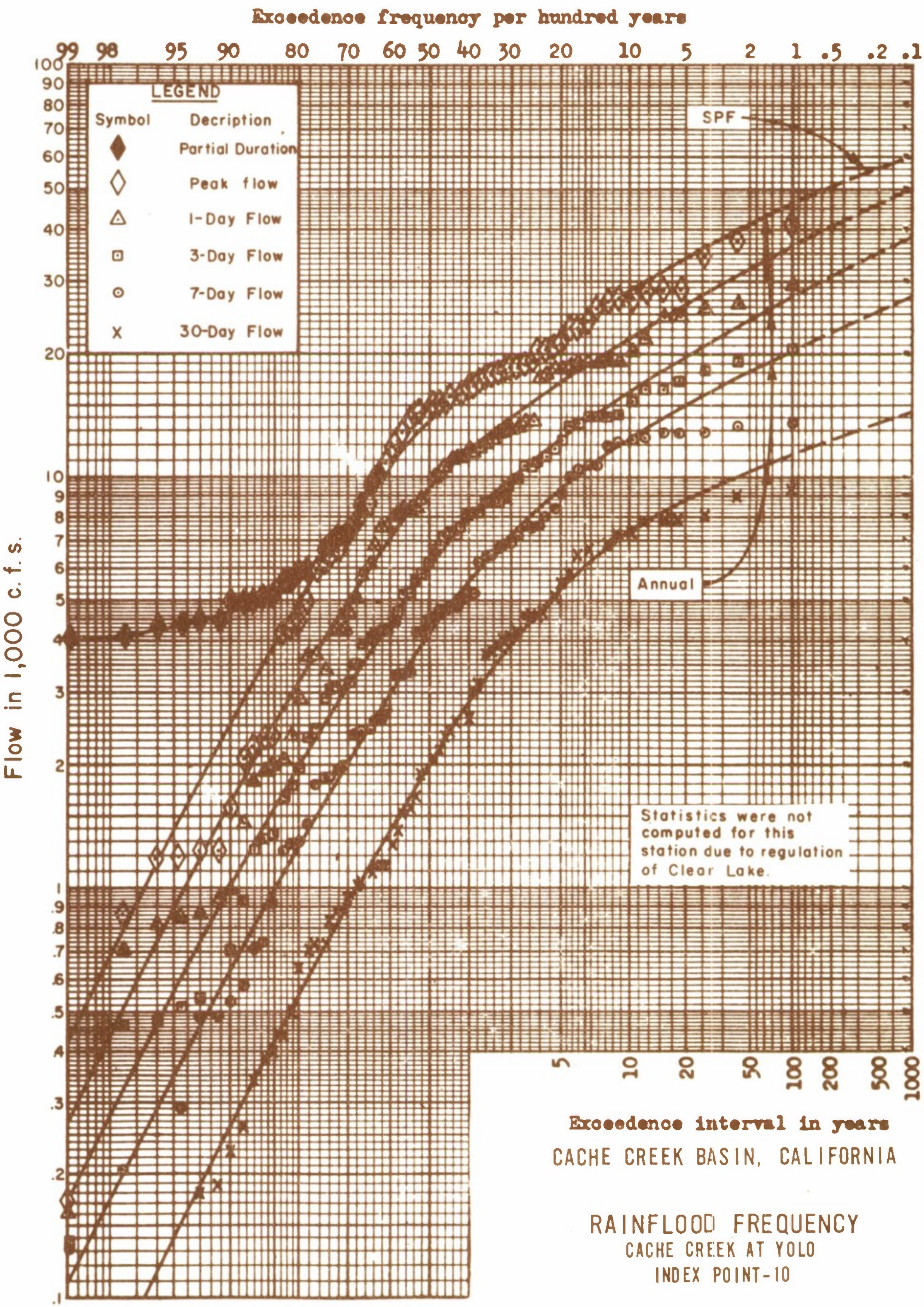
CACHE CREEK BASIN, CALIFORNIA

RAINFLOOD FREQUENCY
CACHE CREEK NEAR CAPAY
INDEX POINT-8

DA: 1044 sq. mi.

Period
1943-1971

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



CACHE CREEK BASIN, CALIFORNIA

RAINFLOOD FREQUENCY
CACHE CREEK AT YOLO
INDEX POINT-10

DA: 1139 sq. mi.

Period
1902-1971

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

NOTES:

Preproject Standard Project Flood plain elevation is 13.01 feet on the Rumsey Gage at Lakeport (1,331.66 feet Mean Sea Level Datum).

Preproject 100-Year flood plain elevation is 11.85 feet on the Rumsey Gage at Lakeport (1,330.50 feet Mean Sea Level Datum).

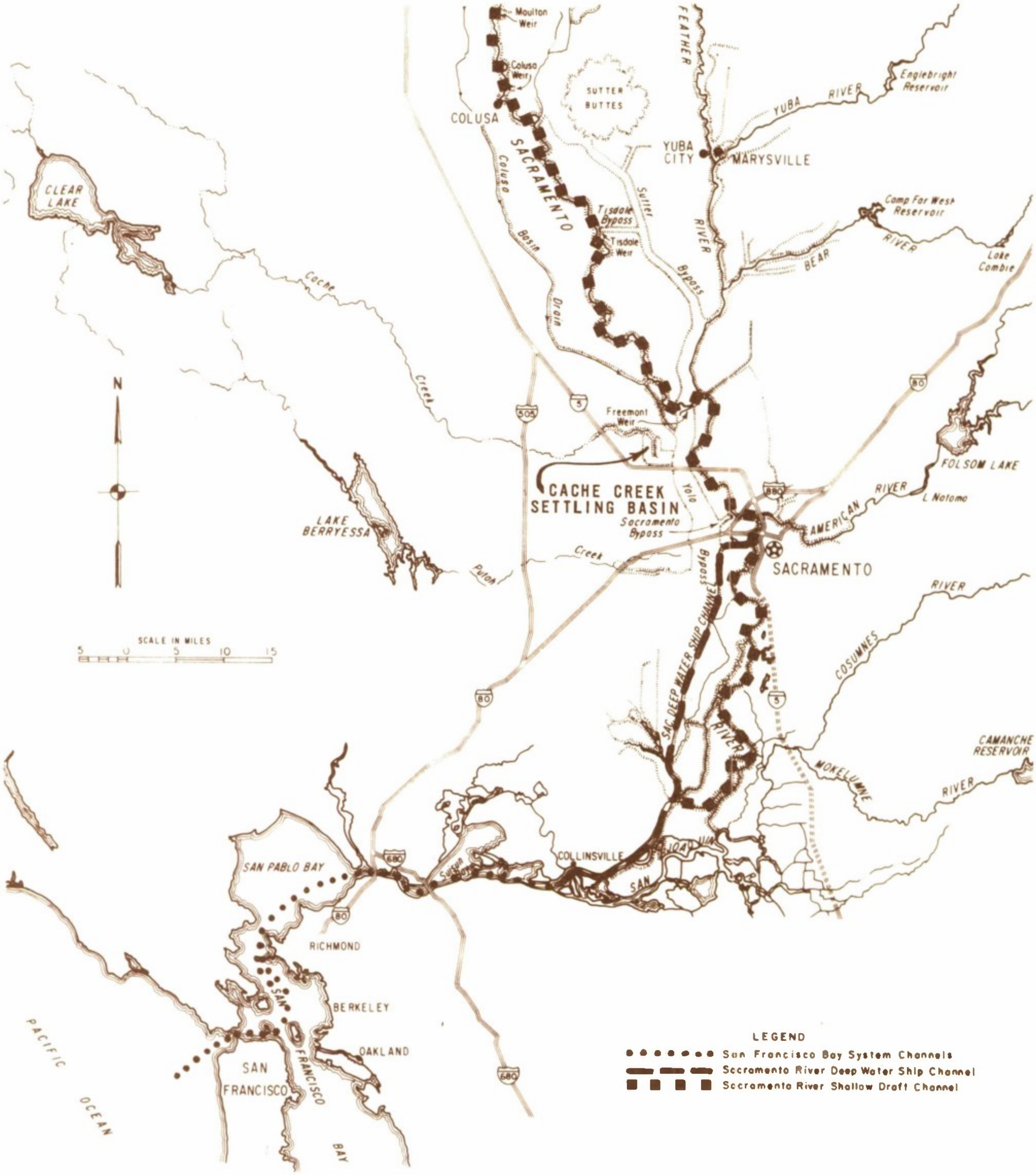
LEGEND

....	100-Year flood plain
― ― ― ―	Standard Project Flood plain

CACHE CREEK BASIN, CALIFORNIA

PREPROJECT 100-YEAR AND STANDARD PROJECT FLOOD PLAINS CLEAR LAKE

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

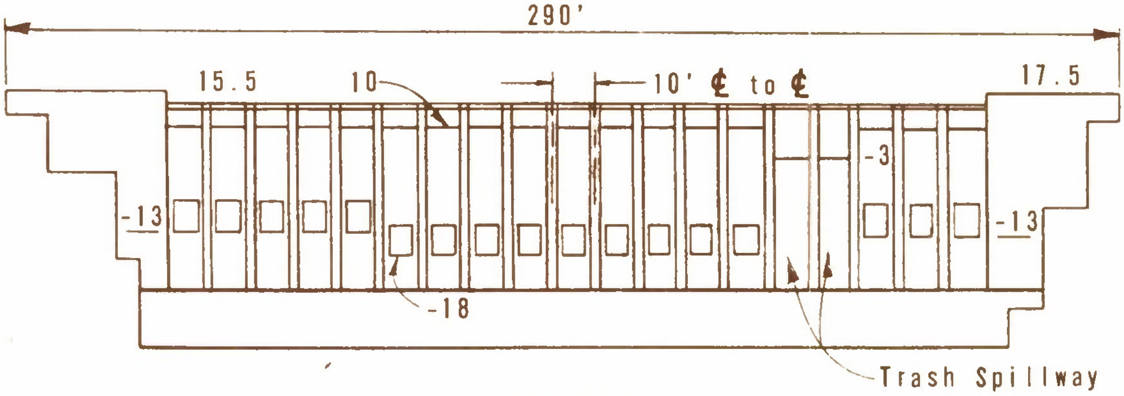


CACHE CREEK BASIN, CALIFORNIA

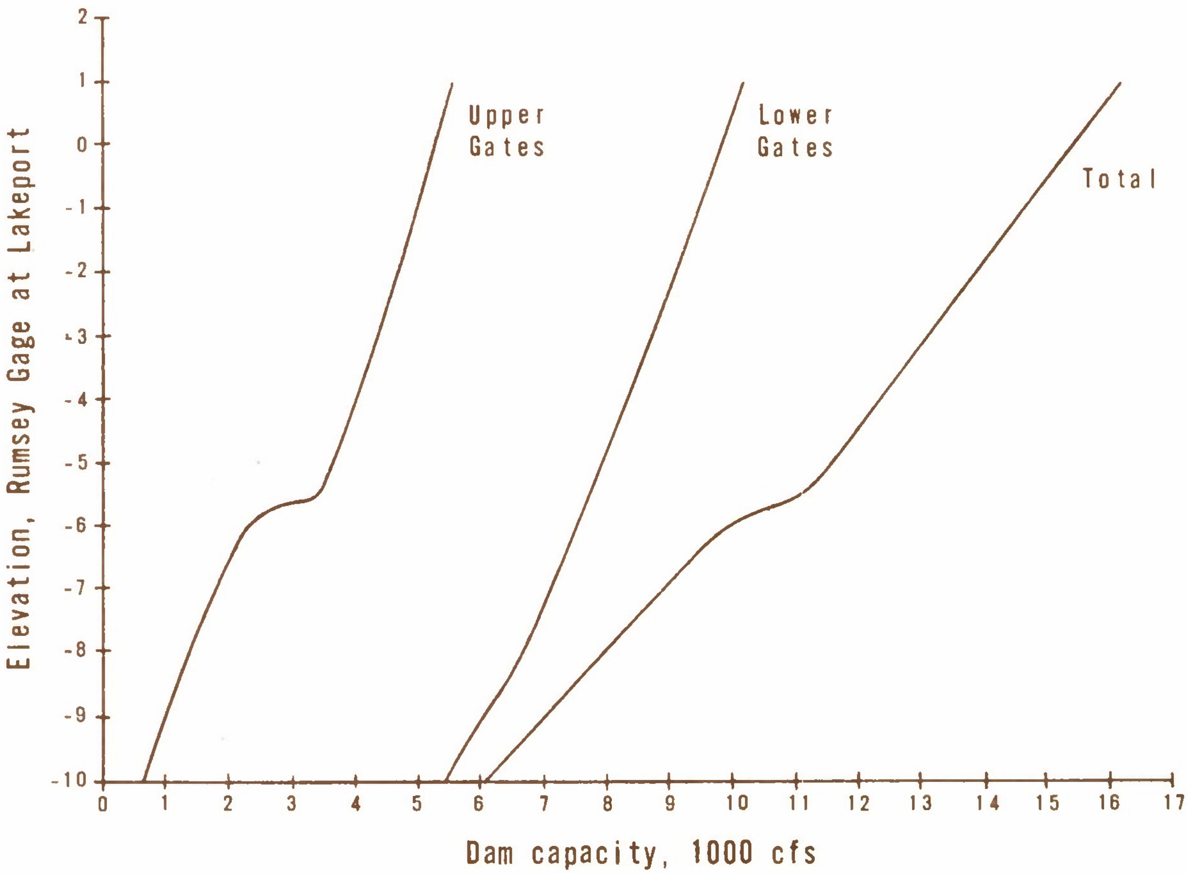
SACRAMENTO RIVER AND
SAN FRANCISCO BAY CHANNELS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

AUGUST 1977



DAM FACE
LOOKING DOWNSTREAM
(Not to Scale)



NOTE:

Dimensions of all 17 gates are 6' horizontal x 7' vertical. Numbers shown on dam sketch are Rumsey Gage elevations. Zero on Rumsey Gage is 1318.65 feet m.s.l. datum.

CACHE CREEK BASIN, CALIFORNIA

CLEAR LAKE DAM

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
MAY 1979

SECTION D

FORMULATING THE PLANS

FORMULATING THE PLANS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

LIST OF PLATES

TABLE OF CONTENTS (Cont'd)

LIST OF PLATES (Cont'd)

SECTION D

FORMULATING THE PLANS

1. Summarized in this section is the plan formulation analysis made to select, from viable alternatives, a plan to resolve the problems and fulfill the needs in the study area. The following paragraphs present the evaluation criteria used in formulating a plan, alternative solutions considered, and the procedure used in eliminating alternatives to arrive at the selected plans.

Formulation and Evaluation Criteria

2. Alternative plans were formulated and evaluated in accordance with various technical, economic, environmental, and socioeconomic criteria. When applied, these criteria provide for responding to the problems and needs of the area by selecting a plan in the best public interest, consistent with other developments in the area, and developing an economically feasible solution.

3. Federal policy on multiobjective planning, derived from both legislative and executive authorities, establishes and defines the national objectives for water resource planning, specifies the range of impacts that must be assessed, and sets forth the conditions and criteria which must be applied when evaluating plans. Plans must be formulated considering benefits and costs, both tangible and intangible, and effects on the environment and social well-being of the community.

4. The planning criteria used are consistent with Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources" (P&S), which requires the systematic preparation and evaluation of alternative solutions to problems, under the objectives of National Economic Development (NED) and Environmental Quality (EQ). P&S also requires that the impacts of proposed actions be displayed under four accounts: NED, EQ, Regional Development (RD), and Social Well-Being (SWB).

5. Plan formulation criteria include published regulations and principles adopted by the Water Resources Council and implementing regulations developed by the Corps of Engineers. A listing of pertinent laws, regulations, and guidance applied in this study is presented below.

a. Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources," dated 1973, prepared under authority of Section 103 of the 1965 Water Resources Planning Act (Public Law 89-80). Guidance for implementation of Principles and Standards is contained in

Corps of Engineers Regulations (ER) 1105-2-200, -210, -220, -230, -240, -250, and -921.

b. Water Resources Development Act of 1974 (Public Law 93-251).

c. Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500).

d. Section 122 of the River and Harbor and Flood Control Act of 1970 (Public Law 91-611).

e. Section 102(2)(c), National Environmental Policy Act of 1969 (Public Law 91-190) and implementing instructions contained in ER 1105-2-507, "Preparation and Coordination of Environmental Statements."

f. Flood Disaster Protection Act of 1973 (Public Law 93-234) and implementing guidelines contained in ER 1105-2-351, "Evaluation of Beneficial Contributions to National Economic Development for Flood Plain Management Plans."

g. "Survey Investigations and Reports, General Procedures," outlined in EM 1120-2-101, as amended by subsequent engineering regulations, and ER's 1105-2-402 and 403, "Organization and General Content of Feasibility Reports" and "Format and Appearance of Feasibility Reports."

h. Other specific engineering regulations pertaining to planning of flood control and related water resource problems.

Technical Criteria

6. The following technical data and criteria were adopted in developing the plans:

a. The plans should be consistent with the California Water Plan and the General Plans for Lake and Yolo Counties.

b. Provisions should be made for drainage of lands adjacent to proposed levees.

c. Plans developed should be consistent with provisions of the National Flood Insurance Program.

d. During the flood season, the storage of Clear Lake should be controlled, to the maximum extent possible, to the current nondamaging level of 7.56 feet on the Rumsey gage at Lakeport (1326.21 feet, m.s.l. datum). The nondamaging Cache Creek flow of 20,000 cfs at the downstream community of Rumsey should be a factor in determining operation of Clear Lake for flood control.

e. Clear Lake should be operated so that the existing water rights are preserved.

f. Historical sediment flow and deposition should be used as a basis for future sediment storage requirements.

g. The useful life of any sediment control project should be as long as possible, considering constraints of physical practicality and economic feasibility.

h. At least 50 percent sediment reduction should be provided since historically this has permitted adequate control of the Cache Creek sediment flow into the Yolo Bypass.

i. Flood control evaluations should be conducted assuming the authorized Lakeport Lake project would not be in operation. This assumption is consistent with recent reclassification of the Lakeport Lake project to "deferred" status.

Economic Criteria

7. Economic criteria for formulation of the plans are summarized as follows:

a. The benefits and costs should be expressed in comparable terms as fully as possible. All evaluations of alternatives should be based on October 1977 prices, an interest rate of 6-5/8 percent, and 100- and 50-year project lives for flood control and sediment control alternatives, respectively.

b. Each alternative considered in detail must be "justified" in the sense that total beneficial effects (monetary and nonmonetary) associated with the objectives are equal to or exceed the total adverse effects (monetary and nonmonetary) associated with the objectives.

c. The selected plans must have net national economic benefits unless the deficiency in net benefits incurred is associated with attaining environmental quality objectives.

d. The size of the flood control project selected should be based on providing the maximum net benefits; however, environmental quality and intangible considerations could dictate a project larger or smaller in size which would forego some of the net tangible benefits.

e. Project benefits should be based on analysis of conditions without and with a project, using methodology described in P&S and Corps of Engineers regulations.

Environmental Criteria

8. The following environmental criteria are applicable to the formulation and evaluation of plans:

a. Plans should be formulated to the extent practicable to preserve and enhance the quality of the natural environment, specifically including

fish and wildlife, vegetation, land, air, water, open space, and scenic and esthetic values.

b. Detrimental environmental effects should be avoided where possible, and feasible mitigation for unavoidable effects should be included.

c. The relationship of the proposed action to land use plans should be considered, and the environmental impact of any proposed action should be evaluated. Any adverse environmental effects which could not be avoided, if a proposal were implemented, should be delineated; alternatives to such proposed action should be identified; the relationship between local short-term uses and the maintenance or enhancement of long-term productivity should be determined; and any irreversible and irretrievable commitments of resources involved if a proposed action were implemented should be identified.

Socioeconomic Criteria

9. The following socioeconomic criteria are applicable in this study.

a. Consideration should be given to evaluating and preserving historical, archeological, and other cultural resources.

b. Consideration should be given to safety, health, community cohesion, and social well-being.

c. Displacement of people should be minimized to the extent practicable.

d. Improvement of leisure activities and public facilities should be evaluated.

e. Effects of a project on regional development, including income, employment, business and industrial activity, population distribution, and desirable community growth, should be considered.

f. General public acceptance of possible plans should be determined by coordination with interested Federal and non-Federal agencies, various groups, and individuals by means of public meetings, field inspections, informal meetings, letters, and other public involvement procedures.

g. The plans should be workable within the constraints of present and potential governmental structure function, relationships, and associations in the study area.

Possible Solutions

10. For evaluation purposes the alternative plans developed for the Cache Creek Basin are divided into two main categories: (1) flood control in the upper basin (Clear Lake) and (2) sedimentation control in the lower basin (Cache Creek). Beginning on page D-15 is a list and brief description of the 19 alternatives investigated to assist in alleviating water resource related problems in the Basin. Following is a brief discussion of the two main problem areas recognized and the rationale used in developing plans for solutions to the problems.

Upper Basin (Clear Lake)

11. Flooding around the rim of Clear Lake generally occurs when inflow to the lake greatly exceeds the discharge capability of the Clear Lake Outlet Channel for long periods of time. Most of the inflow to the lake must be stored in the lake; and as the lake level rises, adjacent developments are damaged. This problem could be resolved by (1) flood proofing existing development and regulating future growth in the flood plain; (2) controlling inflow to the lake; or (3) increasing outflow from the lake.

12. Preliminary studies show that additional storage facilities, if constructed on tributaries to Clear Lake, could retain enough floodwater to reduce perimeter flooding. However, numerous storage reservoirs would

be necessary to adequately reduce the flood problem, and the cost of such a system of reservoirs would greatly exceed the flood control benefits.

13. Since adequate control of inflow to Clear Lake was determined to be economically infeasible, flood control measures that were studied further were then limited to (1) nonstructural alternatives such as flood proofing development and (2) modification of the Clear Lake Outlet Channel to increase outflow. It should be noted that in order to alter the existing outlet channel to increase its presently insufficient capacity, the Gopcevic Decree (1920) may require modification, but the Bemmerly Decree (1940) would have to be modified, since it prohibits enlargement of the channel.

14. The Gopcevic Decree stemmed from a suit by various private individuals and companies against the then-named Yolo Water and Power Company, which held appropriated rights to water from Cache Creek and was pumping water out of Clear Lake into the outlet channel to satisfy downstream water users. This pumping, coupled with drought years of 1919-1920, caused damages by leaving docks and associated recreation-oriented facilities out of water and also damaged agricultural operations. Other individuals held that a low lake level was advantageous since it helped to prevent the periodic flood damages around the lake. A compromise was reached, and in 1920 the Decree was enacted, stipulating a minimum and maximum lake level within which Yolo County was required to operate for irrigation purposes and prohibiting any alteration of the

outlet channel except that necessary to carry out the provisions of the decree. Subsequent to the above-normal winter rainfall of 1937-1938, severe flooding occurred around Clear Lake. As a result, Lake County appealed to the State of California for relief. A study was authorized, resulting in recommendation of clearing the Clear Lake Outlet Channel. The Clear Lake Water Company, which then owned water rights on Clear Lake, supported the proposed action. Channel excavation work was begun, with the intent of increasing the capacity of the outlet channel. In April 1938 downstream property owners in Yolo County brought suit against Lake County, the State of California, and the Clear Lake Water Company, complaining that increased flows out of Clear Lake made possible by enlargement of the outlet channel would only add to the already present flood problems downstream from Rumsey to Capay (because of channel excavation, flooding is not a problem from Capay to the project levees). In 1940 a decision was rendered permanently restraining the defendants from further excavation in the outlet channel. The decision, called the Bemmerly Decree, was appealed and upheld in 1942. These two decrees have had a minimal effect on controlling flooding on the lake perimeter. The Gopcevic Decree was a concession to those preferring a high lake stage since it prohibited a lake level below zero feet on the Rumsey gage at Lakeport. It was also a concession to those preferring a low lake stage since it prohibited a lake stage above 7.56 feet, the only exception being an allowance of lake stage between 7.56 and 9.0 feet for the temporary storage of floodwaters, but not to exceed 10 consecutive days. The unrealistic nature of these requirements is evidenced by the floods of

1958 and 1970. In 1958 the elevation of Clear Lake reached a maximum of 10.88 feet, exceeded 9.0 feet for 43 days, and exceeded 7.56 feet for 82 consecutive days. In 1970 the lake reached a stage of 10.47 feet, exceeded 9.0 feet for 16 days, and exceeded 7.56 feet for 44 consecutive days. If the outlet channel had been enlarged, the magnitude and duration of these violations of the Gopcevic Decree could have been significantly decreased, but such enlargement is specifically prohibited by the Bemmerly Decree.

15. It is apparent that at the time of inception of the decrees, insufficient consideration was given to establishing an operation scheme that could permit enlarging the outlet channel, thereby reducing the flood damage potential without inducing significant detrimental effects downstream.

Lower Basin (Cache Creek)

16. Flood problems in the lower reaches of the Cache Creek Basin are not as great as those adjacent to Clear Lake. Extensive channel excavation by gravel operators in the reach from Capay downstream to the settling basin has considerably increased the channel capacity, thereby reducing the overbank flood damage potential. The Indian Valley Reservoir, recently constructed by Yolo County, will reduce peak floodflows in Cache Creek downstream of its junction with North Fork Cache Creek, further reducing flood damage potential. Hydraulic studies verify these statements and indicate that, presently, the only portion of the Cache Creek Basin

warranting further investigation of flood control problems is that area in the immediate vicinity of Clear Lake.

17. It is estimated that well over 1 million cubic yards of sediment annually are transported by Cache Creek downstream to its mouth. The primary function of the sediment control alternatives discussed herein is to eliminate an adverse impact on the Yolo Bypass floodflow capacity from deposition of Cache Creek sediments in the bypass. Sediment that flows into the Yolo Bypass poses the additional threat of continuing downstream and depositing in the Sacramento River and San Francisco Bay shipping channels, shown in plate C-20, where it would have to be removed by dredging at a substantial cost.

18. Control of the sediment problem on Cache Creek can be achieved by (1) stabilizing the sediment source to prevent sediment inflow to the stream, (2) trapping the sediment at upstream locations closer to its source, or (3) providing additional sediment storage capacity in the downstream areas. Although the streambanks along a major portion of Cache Creek are composed of easily erodible material, they are not considered the major source of sediment that eventually reaches the downstream areas. The major source is hillside and sheet erosion in the Capay Valley, above Capay. One method of preventing Cache Creek sediments from depositing in the Yolo Bypass, as indicated, is to prevent the sediment from entering the stream initially. The difficulty, however, is that the source is widely distributed. Control at the source would, therefore, require modification of large land areas through planting, irrigation, slope stabilization, etc., but Corps studies have shown this method of control to be

economically infeasible because of the vast area that would have to be modified. Further, such an attempt to control sediment inflow to Cache Creek would be impracticable due to the steep terrain. Studies currently being conducted by other agencies under the authority of Section 208 of Public Law 92-500 are addressing this issue, particularly with regard to land erosion. The array of alternatives investigated in more detail was limited, therefore, to those that would prevent sedimentation by trapping the loose material at some location upstream of the Yolo Bypass but within Cache Creek. This function is currently being performed by the Cache Creek Settling Basin, located adjacent to the Yolo Bypass. However, the basin was built in 1937 and has served its useful life. It is essentially filled with sediment and now intercepts only a small portion of the over 1 million plus cubic yards that, on the average, annually flow into the settling basin. Acquiring additional land to construct new settling basin(s) north of the existing basin would offer an unacceptably short-term solution to the problem and is therefore not feasible.

19. Following are descriptions of alternative solutions considered to alleviate the flood and sediment control problems of the study area. Although several alternatives are possible to solve the water resource problems and needs, many of the measures are neither practical nor economical. Accordingly, analysis of the various alternatives was made in varying detail as required to eliminate impractical or infeasible alternatives from further consideration. The general location of the upper basin alternatives considered is shown on plate D-1; plate D-2 shows the general location of the lower basin alternatives.

Rev. 15 Aug 79

UPPER BASIN (Clear Lake)

- Plan 1 - No action
- Plan 2 - Flood forecasting
- Plan 3 - Evacuation of the flood plain
- Plan 4 - Flood proofing existing facilities
- Plan 5 - Flood proofing future facilities
- Plan 6 - Reservoir storage on tributaries
- Plan 7 - Modify operation of Clear Lake for flood control
- Plan 8 - Clear Lake Outlet Channel enlargement
- Plan 9 - Clear Lake Outlet Channel enlargement and bypass
- Plan 10 - Clear Lake Outlet Channel enlargement and modified bypass

LOWER BASIN (Cache Creek)

- Plan 11 - No action
- Plan 12 - Nonstructural alternatives
- Plan 13 - Raise Settling Basin levees
- Plan 14 - Raise Settling Basin levees with wildlife refuge
- Plan 15 - Excavate Settling Basin
- Plan 16 - New North Settling Basin
- Plan 17 - New South Settling Basin
- Plan 18 - Kellner Jetty System
- Plan 19 - Brooks Sediment Reservoir

PLAN 1 - NO ACTION

20. Under this plan, the Federal Government would take no action to alleviate flood problems. Existing fish and wildlife habitat would be left undisturbed, except when changed by flooding or natural processes or lost as a result of development. Lake County can be expected to continue its participation in the National Flood Insurance Program, which requires that future development be flood proofed to at least the elevation of the 100-year flood. No action would mean that storms occurring in the future similar to storms in the past would cause significant flood inundation damages even with restrictions imposed on development of Clear Lake rim. This alternative was considered further in order to compare the effect of the proposed plans to conditions expected to occur with no Federal participation.

PLAN 2 - FLOOD FORECASTING

21. Presently, weather conditions and lake and stream stages are monitored by the joint Federal-State River Forecast Center in Sacramento. When flooding is imminent, the State Flood Operations Center operates for 24 hours a day in conjunction with the River Forecast Center. These Centers furnish flood information to agencies for dissemination to the public. The Flood Operations Center coordinates flood fighting activities throughout the State and is authorized to receive requests from local

public agencies for assistance during floods. This system of forecasting currently provides sufficient warning of impending danger, and modification of the system is not warranted.

PLAN 3 - EVACUATION OF THE FLOOD PLAIN

22. Future structural damage can be prevented by permanently evacuating persons and property from the flood plain if lands are purchased in fee; however, whether such measures are feasible depends upon the value of lands and existing structures and the availability of alternative development sites. By evacuating all structural development from the flood plain, about $1.2 million in flood damages would annually be prevented. However, Clear Lake rim damageable property valued at about $43.7 million, amortized over 100 years, would total $2.9 million, annually. Since this cost, which does not include such items as land, utilities, and relocation costs, exceeds benefits which could be derived, this alternative was considered economically impractical and was not considered further. Additionally, this plan would not be socially acceptable since it would involve displacement of about 1,200 residences and commercial structures, many of which were specifically located adjacent to Clear Lake to take advantage of its scenic and recreational values.

PLAN 4 - FLOOD PROOFING EXISTING FACILITIES

23. Typically, flood proofing measures include elevating or placing floodwalls around structures. For homes on the shores of the lake,

floodwalls, which add substantially to the cost of protection, would have to be constructed. For commercial structures in the flood plain, placing barriers at doorways, low windows, and other openings was considered. However, because flood proofing all existing facilities in the flood plain would cost in excess of $1.5 million annually, while damages prevented would total about $1.2 million annually, this plan would not be economically viable and was therefore not considered further. This alternative is opposed by local interests since it would involve flood proofing about 1,200 existing structures at local expense.

PLAN 5 - FLOOD PROOFING FUTURE FACILITIES

24. With this alternative, future development would be flood proofed to the level of the Standard Project Flood elevation. Flood proofing would consist of elevating future buildings on pads or piles, constructing dikes, providing watertight closures and anchorage systems, waterproofing, or using any other method designed to resist inundation. Expenses would be borne by individual property owners. Studies have shown this plan to be economically feasible; therefore, it is discussed in greater detail later in this section.

PLAN 6 - RESERVOIR STORAGE ON TRIBUTARIES

25. With this plan, reservoirs would be constructed on tributary streams to Clear Lake to provide for flood control and related purposes.

Reservoir sites investigated included Pitney Ridge at Middle Creek, Excelsior site on Copsey Creek, and Kelseyville site on Kelsey Creek. Corps studies of the Kelseyville site were discontinued when Lake County initiated studies, as required by Public Law 984, to obtain a Small Reclamation Project Federal loan to construct a reservoir. The other two sites were previously contemplated by the State for inclusion in the California Water Plan, details of which were published in 1957 as Department of Water Resources Bulletin No. 3. Further studies determined that those sites were not economically feasible because numerous storage reservoirs would be necessary to adequately reduce flooding on Clear Lake, and the cost of such a reservoir system would greatly exceed benefits. For example, the first cost of 40,000 acre-feet of flood control space on Kelsey Creek would exceed $30 million. Average annual costs would total about $1.6 million. However, average annual equivalent damages on Clear Lake rim total only $1.35 million, which is less than the cost to provide 40,000 acre-feet of flood control storage. Additionally, at least 100,000 acre-feet of storage is needed to provide a reasonable degree of flood protection to the Clear Lake periphery. Therefore, this plan was not considered further.

PLAN 7 - MODIFY OPERATION OF CLEAR LAKE FOR FLOOD CONTROL

26. This plan would consist of revising the filling curve for Clear Lake so that the lake would not be allowed to fill until late in the spring. The lake would begin filling at a lower level and later date than under present conditions, resulting in a lower average storage level for water

supply purposes to allow increased flood storage space. However, since recreation-oriented development on the rim of Clear Lake depends on high summertime lake stages, and agricultural concerns in downstream Yolo County depend on irrigation water supply from Clear Lake, any modification of existing lake levels in the interest of flood control is not supported by local interests. Also, such modification would be in violation of water rights agreements between Lake and Yolo Counties; these agreements would be difficult to modify in the interest of flood control. For these reasons, this plan was not considered further.

PLAN 8 - CLEAR LAKE OUTLET CHANNEL ENLARGEMENT

27. This alternative, shown in plate D-3, provides for deepening and/or widening about 4.5 miles of the 5-mile-long existing Clear Lake Outlet Channel and relocating two bridges and numerous docks and residences. Also, the construction elevation required by the National Flood Insurance Program would be maintained to the existing level, which under present conditions is the 100-year flood plane elevation of 11.85 feet on the Rumsey gage at Lakeport. If, as this alternative proposes, the Clear Lake Outlet Channel were enlarged and the 11.85-foot construction level were maintained, future development would be protected from a much more infrequent flood than the under existing conditions.

28. Widening and deepening the outlet channel would increase its capacity from 2,500 to 8,000 cubic feet per second (cfs) at a nondamaging Clear Lake water surface elevation of 7.56 feet on the Rumsey gage at Lakeport.

However, releases would be controlled so that downstream property owners would not be subject to increased flood damages. As previously discussed, the Gopcevic Decree (1920) may require modification, but the Bemmerly Decree (1940) would require modification before this alternative could be implemented. Since this plan provides net benefits, it was considered further and is discussed in greater detail later in this section.

PLAN 9 - CLEAR LAKE OUTLET CHANNEL ENLARGEMENT AND BYPASS

29. This alternative is similar to Plan 8 in that the Clear Lake Outlet Channel would be altered to allow increased outflows from Clear Lake. But to lessen the impact of the plan on streamside development, a 1.1-mile-long channel would be constructed to bypass the highly developed portions of the reach, as shown on plate D-4. The remainder of the existing channel both upstream and downstream of the bypass channel would be enlarged as in Plan 8. An economic analysis of this alternative also showed that an 8,000 cfs capacity, which includes flow through both the proposed bypass channel and the existing outlet channel, provides more net benefits than any other capacity. Plate F-1 of this appendix provides results of this analysis.

30. The flood operation criteria established for this alternative and resultant flood control benefits are the same as for Plan 8. This alternative is also subject to restrictions imposed by the Gopcevic and Bemmerly Decrees.

31. Since this plan provides net benefits, it was considered further and is discussed in greater detail later in this section.

PLAN 10 - CLEAR LAKE OUTLET CHANNEL ENLARGEMENT AND MODIFIED BYPASS

32. This alternative is similar to that for enlarging the outlet channel and bypass; however, the bypass channel would be about 2,500 feet longer than that of the previous plan because it would follow a meandering alignment designed to enhance the fish and wildlife resources of the area while also providing the primary function of flood control. The remainder of the existing channel, both upstream and downstream of the bypass channel, would be enlarged as in the previous alternative. An additional fish and wildlife enhancement feature associated with this alternative is the purchase of Anderson Marsh, making possible the preservation of this valuable natural resource of the Clear Lake area to protect against conversion of these lands to other uses unrelated to fish and wildlife preservation. This plan is shown on plate D-5.

33. The flood operation criteria established for this alternative and resultant flood control benefits are the same as for enlarging the Clear Lake Outlet Channel and enlarging the outlet channel and bypass. This alternative is also subject to restrictions imposed by the Gopcevic and Bemmerly Decrees, and modification of the decrees would be required prior to implementation of this alternative.

34. This alternative was considered further, since its implementation would provide net benefits, and is discussed in greater detail later in this section.

Plans - Lower Basin (Cache Creek)

PLAN 11 - NO ACTION.

35. The Federal Government as a result of this investigation would take no action to control sediment or reduce erosion in lower Cache Creek Basin through structural or nonstructural measures.

36. Uncontrolled sediment deposition in the Yolo Bypass would continue at its present rate. By 1975 the settling basin had, essentially, zero sediment trapping efficiency. As a result, the flow, along with its sediment load, passes through the basin, over Cobble Weir, and into the Yolo Bypass. Some of the sediment then deposits in the bypass, and the remainder is carried into the Sacramento River and its San Francisco Bay system ship channels, necessitating dredging from the channels. The portion of this sediment depositing within the Yolo Bypass will eventually require raising the Yolo Bypass, Knights Landing Ridge Cut, and Sacramento River levees to maintain the design flow capacity and to prevent extensive damage and possible loss of life should these levees fail. This alternative was considered further in order to compare the effect of

proposed plans to conditions expected to occur with no Federal participation and to establish a basis for sediment control benefits.

PLAN 12 - NONSTRUCTUAL FLOOD CONTROL ALTERNATIVES

37. Although studies were conducted of nonstructural flood plain management alternatives which could be taken to reduce flood damages in the lower basin along Cache Creek, the major portion of the flood plain in the lower basin is presently used for agriculture and is expected to remain so; therefore, nonstructural measures would not prevent flood damages. As previously noted, flood inundation damages are relatively minor in the lower basin. For these reasons, nonstructural flood control measures in lower Cache Creek Basin were not considered further. The State of California Reclamation Board has recently considered adoption of a designated floodway in the reach from about Interstate 5 upstream to Rumsey. Public hearings have been held, and further consideration is being given to adoption of the floodway.

PLAN 13 - RAISE SETTLING BASIN LEVEES

38. Under this plan, as a sediment control measure, the existing Cache Creek Settling Basin levees would be enlarged to provide an additional 15,500 acre-feet of storage capacity, Cobble Weir would be rebuilt, and the Cache Creek project levees would be enlarged for 0.7 mile upstream of the basin to compensate for backwater effects. The basin would be

purchased in fee and leased back to agricultural interests for production of crops currently being grown. This plan was determined to be feasible and is, therefore, discussed in greater detail later in this section.

PLAN 14 - RAISE SETTLING BASIN LEVEES WITH WILDLIFE REFUGE

39. This plan is identical to plan 13 insofar as sediment control is concerned. However, a wildlife refuge would be established within the confines of the 3,600-acre basin. This plan too was determined to be feasible and is discussed in greater detail later in this section. This plan is shown on plate D-6.

PLAN 15 - EXCAVATE SETTLING BASIN

40. Under this plan, sediment would be removed periodically from the existing basin to a disposal site or for direct use, thereby continually restoring the capacity of the existing basin. Because the storage capacity would be replenished annually, about 60 percent, or 400 acre-feet, of the sediment currently discharging into the Yolo Bypass would be trapped instead in the settling basin. Therefore, about 300 acre-feet of sediment would be prevented from reaching downstream navigation works and would not have to be eventually dredged.

41. Although the State of California has easements on the settling basin lands, it does not have legal rights to remove deposited material;

therefore, further easements for sediment excavation or outright fee purchase of lands would be necessary. With this plan, the 3,600 acres comprising the basin would be purchased in fee and, for optimum use, converted to a National Wildlife Refuge.

42. The soils deposited in the basin are good quality and suitable for agriculture uses such as topsoil and upgrading poorer agricultural land. Settling basin soils are also excellent for construction fill material. However, removal of the sediments for these and other purposes is a problem due to the magnitude of quantities involved (32 million cubic yards made up of inflow of 400 acre-feet annually). The following paragraphs discuss two possibilities of disposing of accumulated sediments by (a) spreading over adjacent agricultural lands and (b) stockpiling adjacent to existing perimeter levees.

a. Spreading 32 million cubic yards of sediments over 5,000 acres of adjacent agricultural lands to a depth of 4 feet would cost about $59 million, which includes a crop loss for 2 years while sediment is being placed. Also, the existing settling basin would need to be purchased at a cost of $2.7 million, and to insure a 50 percent sediment trap efficiency, the Cobble Weir would have to be rebuilt at a cost of about $4 million. Total first cost of this method of sediment disposal would therefore be about $66 million.

b. It would not be possible to stockpile significant quantities of sediment within the existing basin since that would only further deplete

the volume within the basin necessary to convey design flows of 42,000 cfs. Adding 32 million yards of sediment on the outside of and adjacent to existing perimeter levees would cost about $44 million, not including the value of land lost beneath stockpiled sediment. As in a. above, the existing basin would need to be purchased at a cost of $2.7 million, and rebuilding the Cobble Weir would cost an additional $4 million. Total first cost of this method of sediment disposal would be about $51 million.

43. Raising existing perimeter levees to provide an additional 50 years of sediment storage capacity, previously discussed as Plans 13 and 14, would cost about $4.1 million. As in paragraph 42 a. and b. above, purchasing the basin and rebuilding Cobble Weir would cost about $2.7 million and $4 million, respectively. The total first cost of this method of sediment control would be about $11 million. Since this method of sediment control is far less expensive and more environmentally acceptable than methods described in paragraphs 42. a. and b. above, Plan 15 was not considered further. Rather, Plans 13 and 14 were developed further as a more practical and economical solution for sediment control.

PLAN 16 - NEW NORTH SETTLING BASIN

44. This plan would require diverting Cache Creek flows into a new settling basin north of the existing basin, constructing perimeter levees abutting the existing settling basin and Yolo Bypass levees, constructing a new weir, and removing the existing Cobble Weir. Lands within the new

basin would be purchased in fee to assure optimum operation. However, because of the limited storage capacity of 8,500 acre-feet (25-year storage), this plan would not provide a long-term solution; therefore, additional supplemental storage would be required. Physically, the existing settling basin could serve such a purpose. However, in order to do so perimeter levees of the existing basin would have to be raised accordingly for the additional 25 years of storage capacity since the existing basin is full. In addition to the cost of establishing the new basin, an easement to deposit in the existing basin is estimated to cost $1.8 million, and raising the levees of the existing basin and rebuilding the Cobble Weir would cost $6.7 million. An economic evaluation shows that raising the existing levees an additional amount for 50 instead of 25 years of life would be much cheaper than establishing a new basin and manually transferring portions of the deposited sediment to the old basin. It is also expected that local government would object to the loss of tax revenue currently obtained from the land that would be included in the new basin. This would not be a problem with continued use of the existing basin for sediment deposition, as discussed in Plans 13 and 14. For these reasons, this alternative was not considered further.

PLAN 17 - NEW SOUTH SETTLING BASIN

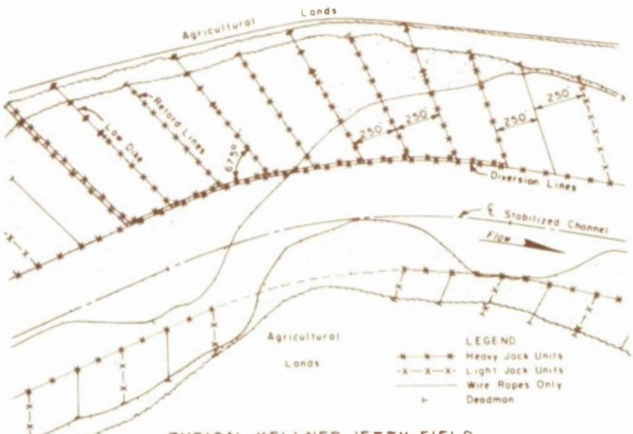
45. This plan would require diverting Cache Creek flows under Interstate 5 into a new settling basin south of the existing basin, constructing perimeter levees abutting the Yolo Bypass, constructing a new weir, and

removing the existing Cobble Weir. The costs for relocating the railway along the southern boundary of the existing basin and constructing Interstate 5 highway structures over the channel would be prohibitively high. These costs would not be necessary if the existing settling basin levees were raised as a means of providing additional storage capacity. Fee purchase of the existing settling basin lands at $2.7 million would be far less expensive than purchasing a comparable amount of more highly productive lands for a new basin. Levees of the existing basin would need to be raised an average of 12 feet, which is about 3 feet less than the height of levees which would be required in a new basin to the south. For these economic reasons, as well as anticipated operational problems associated with conveying design flows past the existing railroad and Interstate 5, this alternative was not considered further in favor of expansion of Plans 13 and 14 as more appropriate and practical means of controlling Cache Creek sediment.

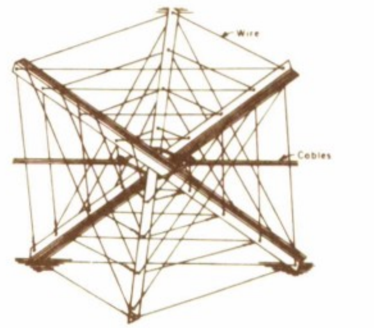
PLAN 18 - KELLNER JETTY SYSTEM

46. With this alternative, sediment would be deposited upstream within a Kellner Jetty System, thus decreasing the amount of sediment reaching the Yolo Bypass by about 33 percent. As shown in the following sketch, this jetty system, made up of iron jacks tied together with steel cable and anchored to the streambank, would have 83,000 lineal feet of jetties distributed among 13 locations between Capay and Yolo, protecting approximately 28,000 feet of channel bank. The system would function to

decrease flow velocities, thereby causing deposition in the jetty field. Eventually, established vegetation within the jetty field would aid in entrapping sediment. Installation of this system would cost about $5.3 million.



TYPICAL KELLNER JETTY FIELD



NOTES:
(1) Unit is usually 16'x4"x4"x¼" angle iron laced with No. 6 wire.
(2) Cables are usually ⅜" ϕ
(3) Above unit is placed 12 ½' on center

STANDARD UNIT KELLNER JACK

47. In order to maintain the 33 percent trap efficiency through the jetty fields, periodic excavation of a portion of the trapped sediment would be necessary; in addition, the 250-foot span between retard lines would allow ample space for excavation in these areas. Similar prototype installations indicate a deposition of 1 to 3 feet per year can be expected; hence, at this rate of deposition, the jetties should be excavated every few years to maintain trap efficiency.

48. Studies have shown that approximately 500 areas of adjacent lands would have to be acquired as disposal areas to guarantee a destination for

the periodically excavated sediment. The cost to move and place the required amount of material would be in excess of $17 million over the 50-year project life. More importantly, the 33 percent trap efficiency through the jetty fields would have to be supplemented by other downstream sediment control measures to achieve the necessary 50 percent trap efficiency. Due to the extremely high cost of installing and maintaining the jetty fields, the fact that they do not achieve the desired trap efficiency, and thus would not solve the sediment deposition problem, and considerable opposition from wildlife agencies and other environmental interests, this plan was not considered further.

PLAN 19 - BROOKS SEDIMENT RESERVOIR

49. With this alternative, a sediment reservoir would alleviate the Cache Creek sedimentation problem by trapping sediment at an upstream location, thus preventing it from reaching the settling basin and Yolo Bypass. The site of the reservoir would be about 3 miles upstream of the Capay Diversion Dam in the lower Capay Valley, near the town of Brooks. This location was chosen because studies have shown that nearly all the sediment load enters the stream upstream of Brooks. The reservoir would function as a large detention basin, causing deposition as water ponded and flow velocities decreased. A consequence of intercepting sediment at this location would be bank erosion and streambed degradation between Capay and the settling basin due to the tendency of the stream to attempt to regain the lost sediment load.

50. The total average annual sediment load at this location is about 1,100 acre-feet. In order to provide a 50-year capacity, 55,000 acre-feet of storage would be required. Although the detention basin would effectively control sediment, the plan is not economically feasible. Its first cost would be nearly $35 million, which is far in excess of potential sediment control benefits it would provide. Also, nearly 3,000 acres of the scenic and highly productive Capay Valley would be inundated over the life of the project if the dam were constructed. For these environmental and economic reasons, this alternative was not considered further.

Alternatives Considered Further

51. Many of the 19 plans previously discussed were eliminated from further consideration because of limited economic feasibility, significant environmental problems, limited potential for providing long-term solutions, or serious consideration of that solution by other agencies. From this analysis, the alternatives listed below were selected for further consideration. A summary of the economic, environmental, and social effects of each of the plans studied in greater detail is presented in tables D-1 and D-2. Each plan calling for Federal participation is economically feasible.

UPPER BASIN (CLEAR LAKE)

No action (Plan 1)

Flood proofing future facilities (Plan 5)

Clear Lake Outlet Channel enlargement (Plan 8)

Clear Lake Outlet Channel enlargement and bypass (Plan 9)

Clear Lake Outlet Channel enlargement and modified bypass (Plan 10)

LOWER BASIN (CACHE CREEK)

No action (Plan 11)

Raise Settling Basin levees (Plan 13)

Raise Settling Basin levees with wildlife refuge (Plan 14)

Upper Basin (Clear Lake)

NO ACTION (PLAN 1)

52. The Federal Government would take no action as a result of this investigation to reduce flood damages by either structural or nonstructural measures. Existing streamflow and lake characteristics or patterns would not be modified, and associated riparian vegetation and wildlife habitat would be left undisturbed, except when changed by flooding or other natural processes or continued development on the lake rim.

53. Lake County is participating in the National Flood Insurance Program for the Clear Lake area in accordance with provisions of the Flood Disaster Protection Act of 1973, Public Law 93-234, and, as required by the program, has enacted zoning ordinances to control and regulate land use and construction within the 100-year flood plain (land area inundated once per hundred years, on the average). The Corps of Engineers completed and in March 1977 submitted flood insurance studies to the Federal Insurance Administration for approval.

54. "No action" would mean that future storms, similar to historic ones, would again, as in the past, cause flooding and related damages. In 1958 about 4,000 acres of residential, commercial, and agricultural lands were inundated, causing an estimated $878,000 in damages (1958 prices). In January 1970 about 1,600 acres were flooded around the rim of the lake, with damages estimated at $485,000 (1970 prices). With this alternative, significant damages could recur in the future even with restrictions imposed on development on the lake rim. People residing around the lake strongly support a project that would reduce the flood stage. For these reasons, "no action" is an unacceptable solution to flood problems in Upper Cache Creek Basin.

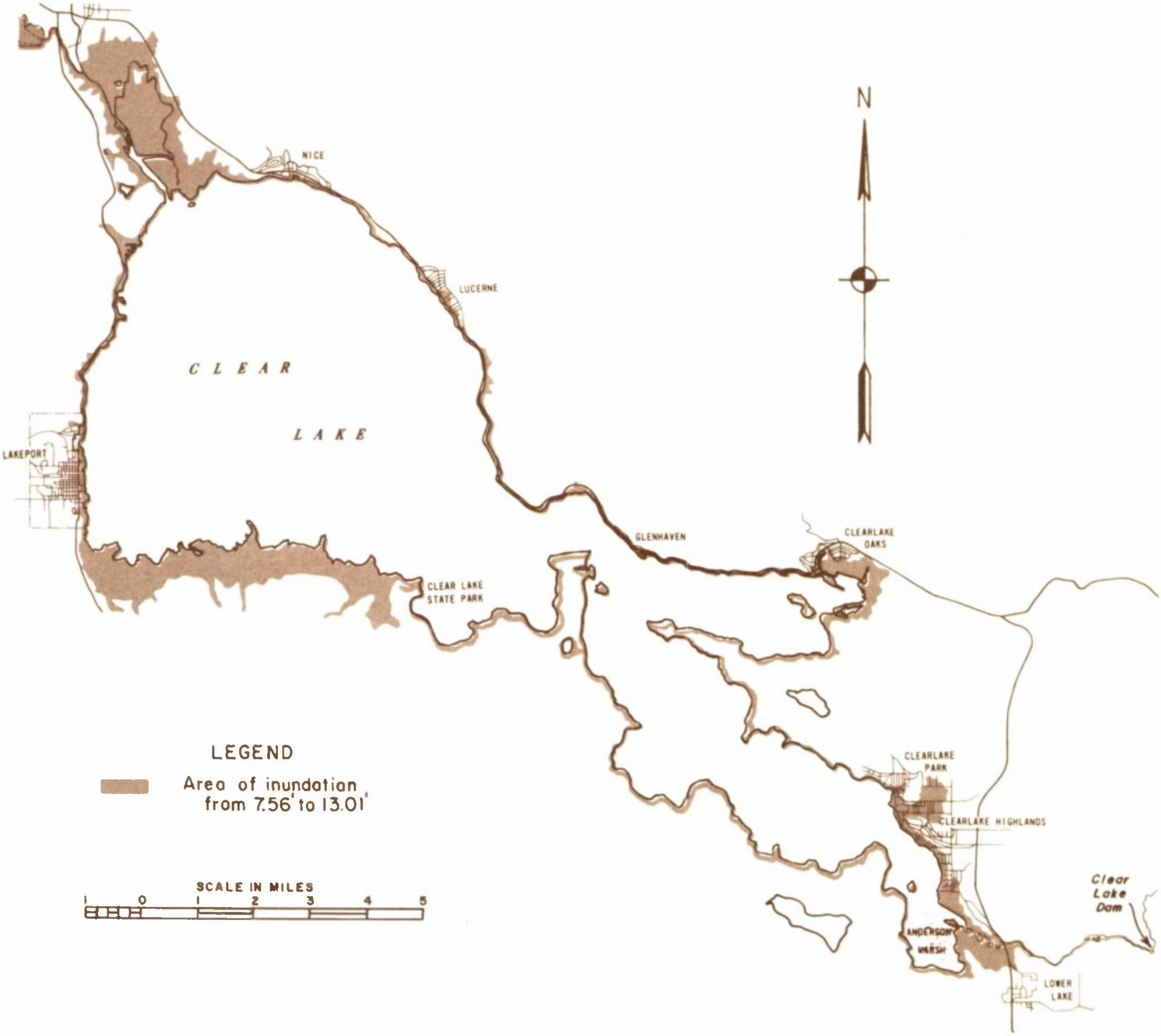
FLOOD PROOFING FUTURE FACILITIES (PLAN 5)

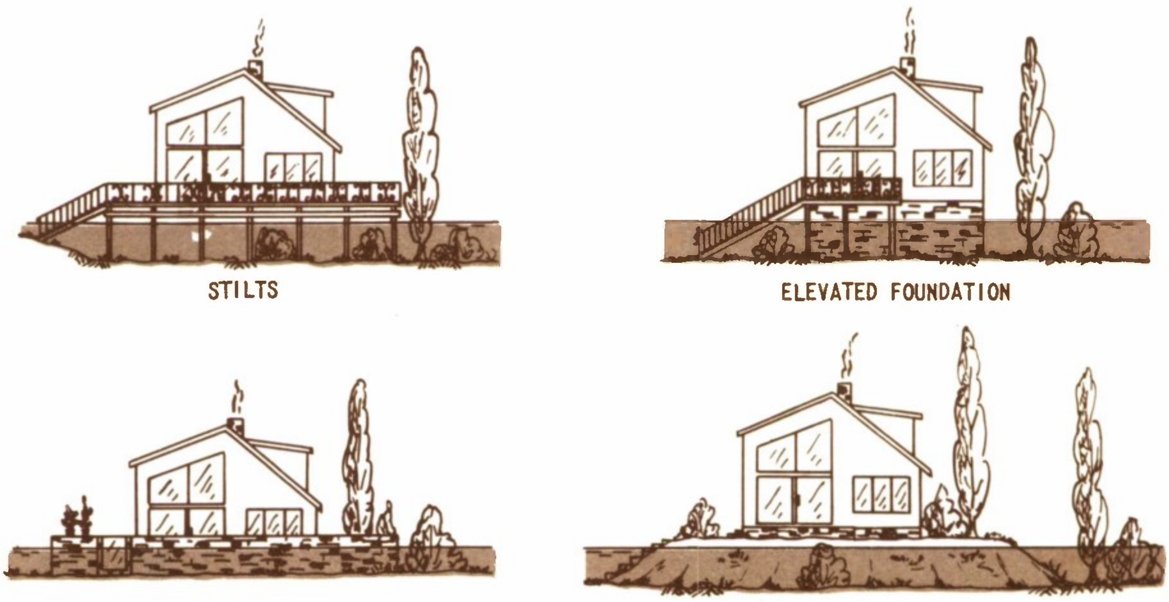
55. As a participant in the National Flood Insurance Program, Lake County is required to adopt ordinances or other controls to regulate land use and

construction within the 100-year flood plain (land area inundated once every hundred years, on the average). The 100-year flood corresponds to a Clear Lake stage of 11.85 feet on the Rumsey gage at Lakeport. Shown on the following page is the area of inundation between the nondamaging Clear Lake stage of 7.56 feet and the preproject SPF elevation of 13.01 feet. Also shown are various methods of flood proofing.

56. With this alternative, an increment would be added to the existing regulated land use to require all future development to be flood proofed to the level of the Standard Project Flood, which is a flood representing the critical flood runoff volume and peak discharge that may be expected from the most severe combination of meteorologic and hydrologic conditions that are considered reasonably characteristic of the hydrologic region involved, excluding extremely rare combinations. For the Clear Lake region, the Standard Project Flood corresponds to a Clear Lake stage of about 13.01 feet (1,331.66 feet m.s.l.) on the Rumsey gage at Lakeport. Flood proofing, in this sense, would consist of elevating future buildings on pads or piles, constructing dikes, providing watertight closures and anchorage systems, waterproofing, or using any other such method designed to resist inundation. Expenses would be borne by individual property owners. With this plan, the increased costs of flood proofing may tend to discourage development in the Standard Project Flood plain, thus satisfying the concerns of wildlife agencies and environmental interests that the Clear Lake rim is already overdeveloped. However, this plan would provide no measure of flood protection to existing development on

the lake rim, a problem which greatly concerns individuals and local government in that area. By letter dated 19 December 1975, the Lake County Flood Control and Water Conservation District objected to this plan by stating the District was already participating in the National Flood Insurance Program. In addition, the letter voiced the concern that the economic and individual costs of flood proofing new and replacement structures would be excessive. In addition, the District stated that the damages and interruption to normal course of business during the long periods when existing roads, sewerlines, and other facilities are inundated by high lake levels are too high a price to pay and would not be alleviated by nonstructural flood proofing methods. The letter concluded by expressing support for enlargement of the Clear Lake Outlet Channel as a means of providing flood control assistance to development on Clear Lake rim. The tabulation below shows average annual equivalent damages and benefits as well as average annual equivalent costs for the flood proofing of future facilities alternative. While economically viable, this alternative would reduce average annual damages by less than 20 percent while providing no benefits to existing developments.





METHODS OF FLOOD PROOFING

Clear Lake Rim - Plan 5 Alternative
Summary of Damages and Benefits
1977 Prices ($1,000)

	1977	1985	1995	2005	2015	2025	2035	2085	Average Annual Equivalent 1985-2085 @ 6-5/8%
Preproject Damages	1338.9	1398.8	1391.1	1385.0	1252.9	1133.0	1153.2	1153.2	1349.7
Residual Damages	1338.9	1318.5	1205.8	1096.8	835.2	600.5	588.2	588.2	1107.5
Project Benefits	0	80.3	185.3	288.2	417.7	532.5	565.0	565.0	242.2
Project Costs									144.0

CLEAR LAKE OUTLET CHANNEL ENLARGEMENT (PLAN 8)

57. With this alternative, shown on plate D-3, 4.5 miles of the existing 5-mile-long outlet channel would be enlarged, necessitating constructing two new bridges at State Highway 53 and old Highway 53 and relocating 18 residences and numerous private docks. In total, 130 ownerships would be affected. However, to minimize relocations, enlargement would be made on only one side of the channel at any one location.

58. The present outlet channel capacity is 2,500 cfs at an estimated nondamaging Clear Lake flood stage of 7.56 feet on the Rumsey gage at Lakeport. Design and cost estimates were made of 5,000, 8,000, and 11,000 cfs enlargement plans, and the economic analysis showed that the 8,000 cfs channel would provide the greatest net benefits (plate F-1).

59. The flood operation goal of all structural plans is to control CLear Lake water surface elevations to 7.56 feet on the Rumsey gage. However, releases would be governed by a downstream Cache Creek flow of 20,000 cfs at the town of Rumsey. When Clear Lake stages reach 7.56 feet on the Rumsey gage at Lakeport and flows at Rumsey exceed 20,000 cfs, releases from the lake would be based on the existing rating curve, as shown on plate D-7. Conversely, when flows at Rumsey are less than 20,000 cfs and Clear Lake stages exceed 7.56 feet, lake releases would be based on the project rating curve, also shown on plate D-7. These criteria were established because a flow of 20,000 cfs was determined to be the nondamaging flow at Rumsey.

60. It is imperative that modified operation of Clear Lake for flood control, made possible by enlargement of the outlet channel, not increase flood or erosion problems downstream. Interests downstream have been concerned that although a sustained flow of 20,000 cfs would not increase flooding, such a flow would increase the erosion problem along Cache Creek downstream of the town of Rumsey. Extensive studies undertaken to address this concern showed that modified operation of Clear Lake would have virtually no effect on downstream erosion. Details of these studies are discussed in Appendix 1, Section E.

61. An additional feature of this alternative is the requirement that future development on the rim of Clear Lake continue to build at or above the 11.85-foot elevation, as currently required by the National Flood Insurance Program, in which Lake County is participating, since this requirement is economically justified. With enlargement of the outlet channel, the level of the 100-year flood elevation on Clear Lake would drop from 11.85 to 9.55 feet. This requirement would accomplish the following two main objectives:

a. Development continuing to flood proof to 11.85 feet would be provided with an extremely high degree of protection, as opposed to 100-year protection under existing conditions.

b. Development would tend to locate outside the flood plain due to increased flood proofing costs. This trend is supported by local

governmental and environmental concerns, including State and Federal wildlife agencies.

62. Local interests have indicated that channel enlargement alone is unacceptable because of the disruption of development along the outlet channel and the relatively high cost of relocations when compared to other alternatives. As noted in table 3, this plan provides identical flood control benefits to Plans 9 and 10; however, its first cost is about 2.1 million in excess of Plan 9, with a significant portion for lands and relocations. The U.S. Fish and Wildlife Service and the California Department of Fish and Game indicate that this plan will be more damaging to fish and wildlife than Plans 9 and 10. This alternative is subject to restrictions of the Gopcevic and Bemmerly Decrees, which were discussed in Section C and paragraph 14.

CLEAR LAKE OUTLET CHANNEL ENLARGEMENT AND BYPASS (PLAN 9)

63. This alternative, shown on plate D-4, is similar to the previously described plan in that it would involve alteration of the Clear Lake Outlet Channel to allow increased flows out of Clear Lake during flood periods. However, in order to lessen the impact of outlet channel modification on streamside development, a 1.1-mile bypass channel would be constructed around the developed portion of the channel. The remainder of the existing channel both upstream and downstream of the bypass channel (3.3 miles) would be enlarged, as in the previous plan. Various bypass

channel lengths were investigated; however, in complying with the desires of local interests, a minimum 1.1-mile-long bypass channel was developed as a part of this plan.

64. The bypass channel, as proposed, would have side slopes of 1/2 Horizontal (H) to 1 Vertical (V) through the portion underlain by rock and 2H to 1V through the portion of the reach with an earth base. It would have a weir at its upstream end and a control structure in the outlet channel adjacent to the weir to control flow into the bypass channel. The channel would be designed so that positive flow would be continuous through both the existing and bypass channels to preclude any stagnant water or entrapment of aquatic organisms. The two structures would also function to ensure design flows would be conveyed down both channels during flood periods. For instance, for a "system" flow of 8,000 cfs, the capacity which provided greatest net benefits, 2,000 cfs would be carried by the existing channel and 6,000 cfs by the bypass channel. Riparian species of trees and other vegetation would be planted along the bypass channel to supplement native vegetation which would naturally reestablish.

65. As with the previous alternative, construction would require relocation of numerous docks and 10 private residences. New structures would be required at State Highway 53 and old Highway 53.

66. With this plan, future development would be required to continue to build at or above Clear Lake stage of 11.85 feet, even though the proposed

outlet channel enlargement would decrease the elevation of the 100-year flood stage to 9.55 feet. The flood operation criteria established for this alternative and resultant flood control benefits are the same as for the previously discussed flood control alternative. This plan is also subject to restrictions of the Gopcevic and Bemmerly Decrees.

CLEAR LAKE OUTLET CHANNEL ENLARGEMENT AND MODIFIED BYPASS (PLAN 10)

67. This alternative, shown on plate D-5, is nearly identical to the previously discussed plan in that it would involve constructing a bypass channel and enlarging the existing channel both upstream and downstream of the bypass channel to allow greater releases from Clear Lake during flood periods. This plan differs in the following two specific areas, which were designed to enhance the fish and wildlife resources of the Clear Lake area:

a. The bypass channel would be about 2,500 feet longer than that in the previous plan, or a total of 1.6 miles. It would follow a meandering alignment to enhance fishery and create additional riparian environment for wildlife. However, its enhancement benefits would be minor and not quantifiable since the channel cross section would be trapezoidal and would be maintained in that configuration over the life of the channel. Its capacity to convey floodflows would be identical to the shorter bypass channel.

b. As discussed in Section C, Anderson Marsh, an adjacent 560-acre ecosystem heavily utilized by fish and wildlife, would be purchased and preserved in its natural state to prevent further encroachment by manmade development. The enlarged portion of the outlet channel and the meandering bypass channel are located on the fringes of the marsh. Additional access to the marsh is possible by boat in both the bypass and enlarged existing channels. Purchase of the marsh and establishment of a wetland area comply with "Environmental Criteria" previously established in this section and are consistent with policy defining "environmental quality" as coequal to "national economic development." Such an action is also consistent with Section 150 of Public Law 94-587, which directs that any reports addressing water resources development consider establishment of wetland areas and states that the benefits of such establishment will be at least equal to the cost, which will be borne by the United States. Further, inclusion of the marsh complies with the intent of Executive Order 11990, issued 24 May 1977, which provides that in carrying out water resource planning activities, factors to be considered should include, among others,

> ". . . maintenance of natural systems, including conservation and long term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber and food and fiber resources."

This particular criteria is especially applicable to Anderson Marsh, which is, as previously stated, an extremely valuable natural system susceptible to manmade encroachment. The California Department of Fish and Game previously proposed preservation of the marsh, and many interests, including environmental, have endorsed such preservation.

68. Remaining features of this plan are identical to those of the previously discussed flood control alternatives and include relocating docks and residences, as required; constructing two new bridges; and requiring future development to build to the preproject 100-year flood plain elevation of 11.85 feet. Flood operation criteria, flood control benefits, and the necessity to amend the legal decrees are also the same as previously discussed.

Lower Basin (Cache Creek)

NO ACTION (PLAN 11)

69. The Federal Government as a result of this investigation would take no action to control sediment or reduce erosion in lower Cache Creek Basin through either structural or nonstructural means. Uncontrolled erosion in and along Cache Creek, as well as sediment flow from Cache Creek, can be expected to continue at its present rate. The Cache Creek Settling Basin, which is essentially full, will continue to receive the 1.2 million cubic

yards (675 acre-feet) of sediment annually transported by Cache Creek. The Cobble Weir, which is no longer able to cause ponding and subsequent deposition of the heavier sediments, will allow the sediment-laden water to pass into the Yolo Bypass and downstream into the navigation channels, San Francisco Bay, and eventually, the Pacific Ocean. With no facilities for sediment entrapment, approximately 100 acre-feet (15 percent of total) will annually deposit in the Yolo Bypass immediately adjacent to the Cobble Weir; about 90 acre-feet (13 percent of total) will deposit in the downstream Yolo Bypass, the Sacramento River, and ship channels; about 195 acre-feet (29 percent of total) will deposit in the San Francisco Bay system; and about 290 acre-feet (43 percent of total), composed of fine-grained silts and clays, will be carried out into the Pacific Ocean.

70. Of the sediment which deposits in the downstream Yolo Bypass, the Sacramento River, navigation channels, and the San Francisco Bay system, significant amounts will need to be dredged for navigation maintenance. Of the sediment which deposits in the Yolo Bypass in the immediate vicinity of the Cobble Weir, the following detrimental actions can be expected to occur:

a. In time, 435 acres of industrial waste oxidation ponds owned by the city of Woodland will be completely filled. Proper functioning of the ponds, located in the Yolo Bypass adjacent to the Cobble Weir, has already been impaired by deposition.

b. Backwater effects caused by deposited sediment would eventually necessitate raising levees in the Yolo Bypass, the Knights Landing Ridge Cut, and along the Sacramento River to maintain freeboard standards on these portions of the Sacramento River Flood Control Project. Extensive damage and loss of life can be expected should levees of the Sacramento River Flood Control Project fail in the subject area. For this reason, "no action" by the Federal Government is considered an unacceptable approach to sediment control problems in lower Cache Creek Basin.

71. The aforementioned levee enlargements would not have to be undertaken if other, less expensive structural solutions were developed for sediment control; therefore, the cost of these enlargements was used as a basis for sediment control benefits. Details of this analysis are in Sections E and F of this appendix.

RAISE SETTLING BASIN LEVEES (PLAN 13)

72. This alternative, as shown on plate D-6, would control the large volumes of sediment carried by Cache Creek by causing deposition within the existing Cache Creek Settling Basin. The existing perimeter levees would be enlarged and raised an average of 12 feet to provide the 15,500 acre-foot capacity needed for 50 years of storage. This plan would also include raising the existing project levees from the settling basin mouth upstream to County Road 102. The existing Cobble Weir would be reconstructed to a length of 1,740 feet and provided with the capability

of being raised in 2-foot increments by stoplogs as necessary to maintain a 50 percent sediment trap efficiency. The existing training levees, as shown on plate D-6, are located about 1/2 mile east of the west perimeter levee and regulate the location of the sediment deposition by directing the flow of incoming sediment-laden water. Since the general slope of the settling basin is to the east, the portion of land between these training levees and the west perimeter levee is not being used to its potential; therefore, the existing training levees would be degraded and the material used to construct new levees adjacent to the west perimeter levee.

73. The State of California owns easements for flowage and sediment deposition across settling basin lands, which are privately owned. Rather than leaving the basin lands in private ownership and acquiring additional easements, the 3,600-acre basin would, with this plan, be purchased in fee. The following rationale is provided to describe the trade-off between acquisition of additional flowage easements and fee purchase of settling basin lands:

a. The State of California Department of Water Resources estimates that the total cost to acquire new easements necessary for 50 years of project life would total $1.8 million. These easements would be made up of fee right-of-way for lands necessary to raise perimeter levees an average of 12 feet, right-of-way for Cache Creek floodwaters to flow over basin lands and deposit sediment, and minor provision for controlled excavation of 50,000 cubic yards annually of sediment. It is important to

note that settling basin lands would still be privately owned and operated for agricultural uses; there would be no provision for excavating sediment in excess of 50,000 cubic yards annually (even though 1.2 million cubic yards are annually carried by Cache Creek to the basin); and all easements would expire at the end of the 50-year project life.

b. The Department of Water Resources also estimates that fee purchase of the entire 3,600 acres of the Cache Creek Settling Basin would cost $2,650.000. This price of fee purchase is $850,000 greater than that necessary to acquire the necessary easements described in a. above. However, the following operational advantages would be offered by fee purchase of the basin as opposed to right-of-way acquisition.

(1) Fee ownership would preclude operation and maintenance problems which have historically occurred. For instance, legal decisions have prevented the State from manipulating the Cobble Weir or perimeter levees to increase or prolong sediment entrapment.

(2) Fee ownership would allow the State to dispose of deposited sediment as needed to prolong the life of the basin. As discussed in Section C, deposited sediments are excellent for uses such as topsoil and construction fill material. Such a plan for disposition of deposited sediment would be difficult to arrange for and administer without fee ownership. With this plan 50,000 cubic yards of sediment would be furnished annually for use by local topsoil distributors, in addition to

other demands for sediment that could be established during the life of the project.

(3) Fee purchase would allow the State to lease 2,950 acres from the 3,600-acre basin back to local farmers for continued use in agricultural production. Rental revenues of $60 per acre obtained would be used to offset expenses incurred by construction of the project. The net outlay by the State for this type of operation would be less than that incurred to pay for flowage easements, and much greater operational flexibility would be obtained.

A plan involving easement puchase could materially control sediment. However, such a plan would not be practical or implementable due to operational constraints. For this reason, no alternative "without fee title" was fully developed as a means of solving sediment deposition problems in lower Cache Creek Basin. Plan 14, which calls for dual use of the settling basin for sediment control and wildlife enchancement, uses this information as a basis for cost allocation between the two purposes.

RAISE SETTLING BASIN LEVEES WITH WILDLIFE REFUGE (PLAN 14)

74. This alternative, as shown on plate D-6, is similar to the previous plan in that the existing settling basin would be used to control Cache Creek sediment. Identical with the previous plan, existing project levees would be raised to provide 50 years of storage capacity, the Cobble Weir

would be reconstructed, training levees would be relocated, provisions would be made for furnishing 50,000 cubic yards of sediment per year for use as topsoil, and the 3,600 acres within the settling basin would be purchased in fee. However, rather than leasing the basin back to local farmers for agricultural use as in the previous plan, the entire 3,600 acres would be established as a National Wildlife Refuge. To optimize wildlife enhancement, two refuge sizes (2,300 and 3,600 acres) were investigated. Results of the investigations showed that the 3,600-acre refuge provided greater net wildlife enhancement benefits. In addition, State and Federal wildlife agencies indicated the larger refuge would better serve the need for wildlife management in this portion of the Sacramento Basin. Particulars of refuge establishment, and requirements in coordinating refuge operation with the primary function of sediment control, are as follows:

a. The interior of the basin would be designed to accommodate the refuge and would consist of a system of levees about 3 feet high with 10-foot crown widths. In addition, for necessary water management in operation of the refuge, various canals and pumping facilities would be required to supplement those in existence.

b. Operation and maintenance requirements for the basin would be established such that, in the future, deposited sediment could be excavated to prolong the life of the basin for sediment entrapment. The U.S. Fish and Wildlife Service, by letter dated 5 January 1976, stated

that excavation of sediment from the settling basin on a rotational basis ". . . lends itself to the establishment of a wildlife refuge as a compatible part of the project." The letter further stated that sediment excavation alternatives ". . . offer the best potential to meet the goals of fish and wildlife conservation, flood control, and sediment control."

75. A wildlife refuge, if created within the settling basin, would be a valuable addition to the system of refuges in the Sacramento Basin. The U.S. Fish and Wildlife Service and California Department of Fish and Game indicate that such a refuge would help meet their objectives for wetland preservation in the Central Valley of California and also for additional refuges for migratory birds. Also, by improving waterfowl distribution, disease loss and crop depredation would be decreased. In addition, recreational consumptive uses such as hunting and fishing, as well as nonconsumptive uses such as environmental education, would increase.

National Economic Development (NED) Plans

Upper Basin (Clear Lake)

76. The National Economic Development (NED) Plan is similar to Plan 9, "Enlarge Clear Lake Outlet Channel with Bypass." As in Plan 9, 3.3 miles of the existing 5-mile-long outlet channel would be enlarged and a 1.1-mile-long bypass channel would be constructed; however, to meet the NED objective of providing the greatest net benefits at the least cost, the plan would be modified by eliminating the weir and control structures at the mouth of the bypass, since design flows could be conveyed without these structures. No riparian vegetation would be planted along the bypass channels, thus also lessening costs.

77. Benefits associated with reduced flood damages on the Clear Lake rim would be identical for all structural alternatives that would increase the Clear Lake Outlet Channel to the capacity providing the greatest net benefits, or 8,000 cfs at a Clear Lake stage of 7.56 feet on the Rumsey gage at Lakeport. Table D-3 shows that the NED plan would be the least costly of all structural plans in alleviating flooding in the Upper Cache Creek Basin (Clear Lake).

Lower Basin (Cache Creek)

78. The NED objective can best be met by Plan 14, "Raise Settling Basin Levees with Wildlife Refuge." This plan would fulfill the requirement of a 50 percent sediment trap efficiency at the least cost and, as shown on table D-3, would provide greater net benefits than any other plan developed for sediment control in the lower Cache Creek Basin.

Environmental Quality (EQ) Plans

Upper Basin (Clear Lake)

79. Plan 10, "Clear Lake Outlet Channel Enlargement and Modified Bypass," was selected as the EQ plan based on its potential to improve the quality of natural resources in the area. A meandering 1.6-mile-long bypass channel would be designed to enhance fish and wildlife resources. Also, the 560-acre Anderson Marsh would be purchased and preserved in its natural state to preclude further development or uses other than for fish and wildlife. Purchase and preservation of the marsh has previously been proposed by the State of California.

80. The plan which best meets the environmental quality objective to preserve ecological values is similar to Plan 14, "Raise Settling Basin Levees with Wildlife Refuge." With this plan, the entire 3,600-acre basin would be purchased in fee and a wildlife refuge, compatible in operation with sediment control, would be established. The State of California, potential project sponsor, desires to excavate sediment from the basin over the life of the project to satisfy demands unknown at this time, thereby prolonging the life of the basin and providing a source for the steadily decreasing supply of structural fill material. However, the EQ Plan would differ from Plan 14 in that to enhance wildlife, sediment would not be excavated from the basin. At present, the 3,600-acre settling basin is extensively farmed to rice, corn, tomatoes, and soybeans, and this potential remains even with refuge establishment. Conceivably, the refuge could be established in only a portion of the basin, with the remainder of the lands leased to farmers; thus, revenues obtained would reduce annual operating costs. However, studies have shown that establishing a refuge over only a portion of the 3,600-acre basin, with extensive farming of the remaining portion, would not only disrupt wildlife but would detract from the potential of the refuge for wildlife enhancement. Therefore, with the EQ Plan, the refuge would be established over the entire basin. Nevertheless, "crop-sharing," which allows farming on specified areas of the refuge with a portion of the crop grown left unharvested for use by wildlife, would be possible with this plan. This practice, traditional in many wildlife refuges in the Sacramento Basin, has successfully enhanced other wildlife refuge operations.

Upper Basin (Clear Lake)

81. Based on evaluation of alternatives, the plan which satisfies the concerns of local interests and which would best alleviate the flood problems in the upper basin and the Clear Lake rim is Plan 9, "Clear Lake Outlet Channel Enlargement and Bypass," without the two control structures at the mouth of the bypass channel. Structural plans which warranted further study were those in which the capacity of the Clear Lake outlet facilities would be increased by enlarging the outlet channel and/or constructing a bypass channel to the economically optimized capacity of 8,000 cfs at a Clear Lake stage of 7.56 feet on the Rumsey gage at Lakeport. These structural solutions are considered the most viable means of providing flood protection to existing development, preserving portions of the existing natural channel, and creating additional riparian habitat along the length of the bypass channel. Plan 8, "Enlarge Clear Lake Outlet Channel," is technically and economically feasible but is not favored by local interests because enlarging the channel would be relatively expensive and construction would disrupt the developed portion of the outlet channel. Adding a bypass channel as a feature of the flood control improvement would significantly increase net benefits and decrease the total project cost, including the cost to non-Federal interests due to fewer relocations; furthermore, the bypass channel is strongly supported by Lake County. In addition, to minimize construction, operation, and maintenance costs, local interests prefer the shorter, 1.1-mile-long

bypass channel rather than the modified, 1.6-mile-long channel described in Plan 10, "Enlarge Clear Lake Outlet Channel and Modified Bypass." Purchase of Anderson Marsh is also being contemplated by the California Department of Fish and Game. Nonstructural flood control measures, such as those described in Plan 5, "Flood Proofing Future Facilities," would not protect existing development; also, future development is currently required to flood proof to the 100-year flood level. A comparison of plans developed in detail is shown in Table D-1, Summary of Economic-Environmental-Social Effects.

Lower Basin (Cache Creek)

82. The plan selected as the best to control sediment flows from Cache Creek is Plan 14, "Raise Settling Basin Levees with Wildlife Refuge." With this plan, not only would sediment flow into the Yolo Bypass be limited, but a wildlife refuge established within the settling basin would meet U.S. Fish and Wildlife Service and California Department of Fish and Game objectives for preservation of wetlands and wildlife enhancement. Also, crop depredation losses in surrounding areas would be reduced. Selection of Plan 14 over Plan 13 is consistent with economic, environmental, and socioeconomic criteria listed in Section D of this appendix.

83. Plan 14 was also identified as the NED Plan because the greatest net benefits would be provided. The EQ plan is similar to Plan 14; the difference is that, with the EQ Plan, sediment would not be excavated from the basin so as to minimize disruption to wildlife.

84. Plan 13, "Raise Settling Basin Levees," was also considered further; however, although this plan was technically and economically feasible, it provided lesser net benefits than Plan 14 and did not enhance wildlife.

85. A comparison of plans developed in detail is shown on Table D-2, Summary of Economic-Environmental-Social Effects.

TABLE D-1

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS

ALTERNATIVES	FLOOD PROOFING FUTURE FACILITIES	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (SELECTED PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (NATIONAL ECONOMIC DEVELOPMENT PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND MODIFIED BYPASS (ENVIRONMENTAL QUALITY PLAN)	NO ACTION
I. PLAN DESCRIPTION	Local flood regulatory authority applied to insure proper land use within flood zone. Flood proof future development within standard project flood plain (once in 800 years on the average). Presently Lake County participating in National Flood Insurance Program which requires flood proofing up to 100-year level. Expenses for flood proofing borne by individual property owners.	Enlarge 3.3 miles of outlet channel from capacity of 2,500 to 8,000 cfs at 7.56 feet on Rumsey gage at Lakeport and construct 1.1-mile bypass channel. Plant riparian vegetation along bypass channel. Flood operation criteria function of non-damaging flow of 20,000 cfs at downstream town of Rumsey and control lake stage to 7.56 feet on Rumsey gage at Lakeport. Construct two new bridges. Minimal impact on riparian development. Modification of Bemmerly and Gopcevic Dacres necessary prior to plan implementation.	Same as previous plan, except omit planting of riparian vegetation along bypass.	Enlarge 3.0 miles of outlet channel from a capacity of 2,500 to 8,000 cfs at 7.56 feet on Rumsey gage at Lakeport and construct new 1.6-mile bypass channel and control structures. Plant riparian vegetation along bypass channel. Flood operation criteria function of non-damaging flow of 20,000 cfs at downstream town of Rumsey and control lake stage to 7.56 feet on Rumsey gage at Lakeport. Purchase 560 acres of Anderson Marsh to preserve worth as natural resource. Construct two new bridges. Minimal impact on riparian development. Modification of Bemmerly and Gopcevic Dacres necessary prior to plan implementation.	No action undertaken by Federal Government for flood damage reduction through structural measures.
II. PLAN EVALUATION					
A. Contributions to Planning Objectives					
1. Flood Control	Flood proofing consists of elevating future buildings on pads or piles, constructing dikes, providing watertight closures and anchorage systems, waterproofing, or other such methods designed to resist inundation.	Provide flood protection for homes, commercial developments, and agricultural crops that encircle rim of Clear Lake by increasing the outflow capacity of Clear Lake outlet channel and maintaining current zoning requirements.	Same as Previous Alternative.	Same as Previous Alternative.	- -
B. Relationship to National Accounts (System of Accounts)					
1. NED					
a. Beneficial Impacts					
(1) Value of Increasing Outputs of Goods and Services					
(a) Flood Control	$242,100	$1,170,200	$1,170,200	$1,170,200	- -
(b) NED Employment Benefits		$ 35,700	$ 34,000	$ 45,900	- -
(2) Total Annual Benefits	$242,100	$1,205,900	$1,204,200	$1,216,100	- -
b. Adverse Impacts					
(1) Total Project First Cost		$6,050,000	$8,870,000	$7,324,000	- -
(2) Annual Project Cost	$ 78,800	$ 413,000	$ 397,600	$ 495,900	- -
c. Net Benefits	$163,300	$ 792,900	$ 806,600	$ 720,200	- -
d. Benefit-Cost Ratio		2.9 to 1.0	3.0 to 1.0	2.5 to 1.0	

Index of Footnotes

Timing
1. *Impact is expected to occur prior to or during implementation of the plan.*
2. *Impact is expected within 15 years following plan implementation.*
3. *Impact is expected in a longer time frame (15 or more years following implementation).*

Uncertainty
4. *The uncertainty associated with the impact is 50% or more.*
5. *The uncertainty is between 10% and 50%.*
6. *The uncertainty is less than 10%.*

Exclusivity
7. *Overlapping entry, fully monetized in NED account.*
8. *Overlapping entry, not fully monetized in NED account.*

Actuality
9. *Impact will occur with implementation.*
10. *Impact will occur only when specific additional actions are carried out during implementation.*
11. *Impact will not occur because necessary additional actions are lacking.*

Location of Impacts
12. *Within the immediate planning area.*
13. *Within the study area.*
14. *Within a larger area affected by the project.*
15. *Within the rest of the nation.*

Measure of Impacts
16. *Significant*
17. *Insignificant*

Section 122

**Items specifically required in Section 122 and ER 1105-2-240.*

TABLE D-I

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	FLOOD PROOFING FUTURE FACILITIES	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (SELECTED PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (NATIONAL ECONOMIC DEVELOPMENT PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND MODIFIED BYPASS (ENVIRONMENTAL QUALITY PLAN)	NO ACTION
2. Environmental Quality					
a. Environmental Quality Enhanced					
*(1) Enhance Aesthetics of Area Protected from Floods	Potential reduction of development in Clear Lake flood plain would reduce loss of shoreline vegetation. *(2,5,8,10,13,17)*	1.1-mile-long-bypass channel would create new riparian vegetation along banks. Additional riparian vegetation planted. Vegetation disturbed by enlargement of existing channel replanted. Natural grasses in borrow area would be reestablished. *(1,6,7,9,12,16)*	1.1-mile-long bypass channel would create new riparian vegetation along banks. Vegetation disturbed by enlargement of existing channel replanted. *(1,6,7,9,12,16)*	Same as "Enlarge Clear Lake Outlet Channel and Bypass" plan except bypass is 1.6-mile-long. Also purchase 560 acres of Anderson Marsh to protect the four biogeographical units which collectively form its ecosystem, i.e., marsh, littoral zone, woodland, and chaparral. *(1,6,7,9,14,16)*	- -
(2) Protection of Existing Wildlife Habitat	Potential reduction in development in the Clear Lake flood plain area would reduce the loss of shoreline wildlife habitat. *(2,5,8,10,13,16)*	Project designed so as not to disturb aquatic oxbow habitat. 1.1 miles of new channel capable of supporting aquatic life would be created. *(1,6,8,9,12,16)*	Same as Previous Alternative.	Same as "Enlarge Clear Lake Outlet Channel and Bypass" plan except bypass channel is 1.6-miles long. Also purchase 560 acres of Anderson Marsh would aid in preservation of several species of mammal, 28 species of fish, and 91 species of bird which are known to utilize the area. 3 of the bird species are considered "rare or endangered." *(1,6,7,9,14,16)*	Fishery on Clear Lake and outlet channel will remain stable. Wildlife populations would remain stable.
b. Environmental Quality Degraded					
*(1) Existing Vegetation Lost	Possible increased development outside the flood plain will increase the loss of vegetation in that area. *(2,5,8,10,13,16)*	71 acres grassland lost to bypass channel construction. 3 acres riparian land along 3.3-mile reach of existing channel lost to channel widening. This land supports vegetation such as hardwoods, pines, willows, vines and brush species. *(1,6,7,9,12,16)*	Same as Previous Alternative	Same as previous alternative except bypass is 1.6 miles long and 100 acres grassland lost to bypass channel construction.	Long term decrease in vegetation along lake periphery outlet channel due to replacement of open space and agricultural land with urban development.
*(2) Water Quality	No Effect	Increased turbidity during one construction season within outlet channel and downstream of Clear Lake outlet dam. No impact on algal growth problem in Clear Lake. *(1,6,8,9,13,17)*	Same as Previous Alternative	Same as Previous Alternative	Continued development could cause a long-term reduction in water quality in Clear Lake and Cache Creek. Continued algal problem in Clear Lake.
(3) Air Quality	No Effect	Minor effect by construction equipment exhaust during 1-1/2 construction seasons. *(1,6,8,9,13,17)*	Same as Previous Alternative	Same as Previous Alternative	- -
3. Social Well-Being					
a. Beneficial Impacts					
(1) Health, Safety and Community Well-Being	Flood proofing would increase protection to future development from the public safety hazards associated with flooding. *(2,5,8,10,13,16)*	Safety hazard during construction minimized due to bypassing the most densely populated areas by bypass channel. Project would decrease health hazards associated with flooding along lake rim and outlet channel. *(1,6,7,9,13,16)*	Same as Previous Alternative	Same as Previous Alternative	Newly planned sanitation and water supply systems will reduce public health threat posed by flooding.
*(2) Improvement of Community Cohesion	Flood proofing, although bringing on higher construction costs, would result in a more uniform cost and better quality home within the flood plain. *(2,6,8,10,13,16)*	Dislocation of persons due to flooding reduced. Long-term stabilizing effect on housing around lake and along outlet channel. *(2,6,8,9,13,16)*	Same as Previous Alternative	Same as Previous Alternative	- -
(3) Transportation	No Effect	A long-term benefit would be realized to roads along Clear Lake rim by reducing the flood threat. *(2,6,8,9,13,16)*	Same as Previous Alternative	Same as Previous Alternative	Two new state highway routes are proposed for future construction.
*(4) Improvement of Leisure Activities	No Effect	Effect on riparian recreation oriented development minimized with bypass channel. Minor fishery would be supported in bypass channel. Stabilizing effect on recreation development on lake rim. *(2,6,7,9,13,16)*	Same as Previous Alternative	Same as previous alternative plus preservation of habitat within Anderson Marsh will insure a continuation of associated recreation. *(1,6,7,9,13,16)*	4,780,000 annual user days predicted for Clear Lake by year 2020.

Index of Footnotes

Timing
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2. *Impact is expected within 15 years following plan implementation.*
3. *Impact is expected in a longer time frame (15 or more years following implementation).*

Uncertainty
4. *The uncertainty associated with the impact is 50% or more.*
5. *The uncertainty is between 10% and 50%.*
6. *The uncertainty is less than 10%.*

Exclusivity
7. *Overlapping entry: fully monetized in NED account.*
8. *Overlapping entry: not fully monetized in NED account.*

Actuality
9. *Impact will occur with implementation.*
10. *Impact will occur only when specific additional actions are carried out during implementation.*
11. *Impact will not occur because necessary additional actions are lacking.*

Location of Impacts
12. *Within the immediate planning area.*
13. *Within the study area.*
14. *Within a larger area affected by the project.*
15. *Within the rest of the nation.*

Measure of Impacts
16. *Significant*
17. *Insignificant*

Section 122
**Items specifically required in Section 122 and ER 1105-2-240.*

TABLE D-1

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	FLOOD PROOFING FUTURE FACILITIES	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (SELECTED PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (NATIONAL ECONOMIC DEVELOPMENT PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND MODIFIED BYPASS (ENVIRONMENTAL QUALITY PLAN)	NO ACTION
(5) Improvement of Public Facilities	Land use regulations help preserve any "natural" appearance remaining on the lake periphery in restraining development of shoreline and minimizing landscape alterations. (1,6,8,9,12,16)	Aesthetic losses minimized by use of bypass channel, thereby permitting scenic oxbow areas to remain unaffected, and reducing loss of riparian vegetation along existing channel. Potentially scenic source of new riparian vegetation created along bypass. (1,6,7,9,12,16)	Same as Previous Alternative	Same as Previous Alternative	- -
b. Adverse Impacts					
(1) Community Cohesion	Higher construction costs associated with flood proofing would increase problem of shortage of low to moderate income housing. (1,5,8,9,13,16)	No Effect	No Effect	No Effect	Major flood damage to existing structures along lake rim and outlet channel would continue to occur.
*(2) Displacement of People	- - - -	Ten residences relocated. (1,6,7,9,12,16)	Same as Previous Alternative	Same as Previous Alternative	Evacuation during flooding will continue.
(3) Transportation	Continued flood threat to existing roads and utilities around Clear Lake periphery. (1,6,7,9,13,16)	Reconstruction of 2 new additional bridges on State Highway 53 and old Highway 53 would temporarily affect transportation efficency at these sites. (1,6,7,9,12,16)	Same as Previous Alternative	Same as Previous Alternative	Continued flood threat to existing roads and utilities around Clear Lake periphery.
(4) Noise	No Effect	Minor effect due to construction equipment during one construction season. (1,6,8,9,12,17)	Same as Previous Alternative	Same as Previous Alternative	Increased urban development and recreation use would increase noise levels, but not to unacceptable levels.
*(5) Cultural Resources	No Effect	Wintun and Pomo Indian Villages and Campsites line the periphery of Clear Lake and the outlet channel. Construction works could disturb such sites should they exist. (1,6,7,9,12,16)	Same as Previous Alternative	Same as Previous Alternative	Continued urbanization and agricultural improvements would progressively diminish the rich archeological resources available.
(6) Institutional Relationships	No Effect	Modification of Gopcevic (1920) and Bemmerly (1980) Decrees necessary prior to outlet channel alteration. (1,6,7,9,13,16)	Same as Previous Alternative	Same as Previous Alternative	- -
4. Regional Development					
a. Beneficial Impacts					
(1) Value of Increased Income	Damage reduction to future structural development will increase assessed valuation around lake. (2,5,8,9,13,17)	Flood plain property values would increase, increasing local tax revenues. Reduced emergency flood fighting costs. (1,5,3,9,13,16)	Same as Previous Alternative	Same as Previous Alternative	Riparian property values would increase, providing additional tax revenue.
(2) Quantity of Increased Employment	No Effect	Reduced flood threat would stabilize existing and promote future development, resulting in similar stabilizing effect on local labor force. 21 local workers provided with employment during 1-1/2 construction seasons. Maintenance work required intermittently after construction employing local labor. (1,6,7,9,13,16)	Same as Previous Alternative (except 21 local workers provided employment)	Same as Previous Alternative (except 29 local workers provided employment)	Changes expected to follow rate of population growth. Employment more dependent on commercial trade and services than at present.
(3) Increased Business and Industrial Activity		Retail sales of about $480,000 would benefit local business during construction period. Long-term benefits also realized. (1,6,7,9,13,16)	Same as Previous Alternative	Retail sales of about $475,000 would benefit local business during construction period. Long-term benefits also realized. (1,6,7,9,13,16)	- -
b. Adverse Impacts					
(1) Value of Income Lost	Administration and enforcement of non-structural regulations would be local government costs. (1,6,7,9,13,16)	79 acres of land removed from tax rolls, reducing tax revenues by about $6,800 annually. (1,6,7,9,13,16)	79 acres of land removed from tax rolls, reducing tax revenues by about $6,800 annually. (1,6,7,9,13,16)	79 acres of land removed from tax rolls, reducing tax revenues by about $6,800 annually. (1,6,9,13,15)	- -

Index of Footnotes

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2. Impact is expected within 15 years following plan implementation.
3. Impact is expected in a longer time frame (15 or more years following implementation).

Uncertainty
4. The uncertainty associated with the impact is 50% or more.
5. The uncertainty is between 10% and 50%.
6. The uncertainty is less than 10%.

Exclusivity
7. Overlapping entry, fully monetized in NED account.
8. Overlapping entry, not fully monetized in NED account.

Actuality
9. Impact will occur with implementation.
10. Impact will occur only when specific additional actions are carried out during implementation.
11. Impact will not occur because necessary additional actions are lacking.

Location of Impacts
12. Within the immediate planning area.
13. Within the study area.
14. Within a larger area affected by the project.
15. Within the rest of the nation.

Measure of Impacts
16. Significant
17. Insignificant

Section 122
*Items specifically required in Section 122 and ER 1105-2-240.

TABLE D-I

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	FLOOD PROOFING FUTURE FACILITIES	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (SELECTED PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS (NATIONAL ECONOMIC DEVELOPMENT PLAN)	ENLARGE CLEAR LAKE OUTLET CHANNEL AND MODIFIED BYPASS (ENVIRONMENTAL QUALITY PLAN)	NO ACTION
(2) Business and Industrial Activity	Flood proofing would raise costs of 64 new commercial structures and replacement of 131 existing structures in standard project flood plain between 1985 and 2035. Continued flood damage to existing facilities. (2,6,7,9,13,16)	During construction period, recreation oriented business along outlet channel adversely affected. (1,6,8,9,12,16)	Same as Previous Alternative	Same as Previous Alternative	Commercial and agricultural development would continue to suffer periodic flood damage. Agricultural development would be highly dependant upon development of new water supplies.
(3) Land Use	Additional cost of flood proofing may discourage development in flood prone areas around lake. Future development not directly related to recreation may locate outside standard project flood plain due to increased cost. (2,5,8,9,13,16)	74 acres of grassland and riparian land lost by channel construction and widening. 80 acres of pastureland used for spoil area to be located outside of flood plain to prevent induced development. (1,6,7,9,12,16)	Same as Previous Alternative	100 acres of grassland and riparian land lost by channel construction and widening. 80 acres of pasture land used for spoil area to be located outside of flood plain to prevent induced development. (1,6,7,9,12,16)	Urban development will replace agricultural use of land. Development along lake rim restricted by perennial flood threat
C. Plan Response to Associated Evaluation Criteria.					
1. Acceptability	Medium	High	High	Medium	Low
2. Stability	High	High	High	Medium	Low
III. IMPLEMENTATION RESPONSIBILITY					
A. Corps of Engineers	None	Design, prepare detailed plans and specifications, and construct project.	Same as Previous Alternative	Same as previous plan plus provide 100% of cost to purchase 560 acres of Anderson Marsh to preserve that natural ecosystem.	- -
B. Local Sponsor	Administration and enforcement of non-structural regulations.	Provide all costs for lands, easements, rights-of-way, and relocations, operate and maintain completed facilities for project life.	Same as Previous Alternative	Same as Previous Alternative	- -

Index of Footnotes

Timing

1. *Impact is expected to occur prior to or during implementation of the plan.*
2. *Impact is expected within 15 years following plan implementation.*
3. *Impact is expected in a longer time frame (15 or more years following implementation).*

Uncertainty

4. *The uncertainty associated with the impact is 50% or more.*
5. *The uncertainty is between 10% and 50%.*
6. *The uncertainty is less than 10%.*

Exclusivity

7. *Overlapping entry; fully monetized in NED account.*
8. *Overlapping entry; not fully monetized in NED account.*

Actuality

9. *Impact will occur with implementation.*
10. *Impact will occur only when specific additional actions are carried out during implementation.*
11. *Impact will not occur because necessary additional actions are lacking.*

Location of Impacts

12. *Within the immediate planning area.*
13. *Within the study area.*
14. *Within a larger area affected by the project.*
15. *Within the rest of the nation.*

Measure of Impacts

16. *Significant*
17. *Insignificant*

Section 122

**Items specifically required in Section 122 and ER 1105-2-240.*

TABLE D-2

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
SEDIMENT CONTROL ALTERNATIVE PLANS

ALTERNATIVES	RAISE SETTLING BASIN LEVEES (ENVIRONMENTAL QUALITY PLAN)	RAISE SETTLING BASIN LEVEES (NATIONAL ECONOMIC DEVELOPMENT PLAN, SELECTED PLAN)	NO ACTION
I. PLAN DESCRIPTION	Raise existing settling basin perimeter levees an average of 13 feet to provide 17,000 acre-feet of sediment storage. Reconstruct and enlarge existing cobble weir. Raise weir crest in 2-foot increments with stop logs over project life to maintain 50% trap efficiency. Degrade training levees. Reconstruct training levee adjacent to west perimeter levee to allow maximum utilization of all land within the basin. Purchase in fee the 3,600 acres within the settling basin and establish a wildlife refuge. Operate basin in a dual capacity of sediment control and wildlife enhancement. No provision for excavation of sediment from sediment basin. 50-year project life.	Raise existing settling basin perimeter levees an average of 12 feet to provide 15,500 acre-feet of sediment storage. Reconstruct and enlarge existing cobble weir. Raise weir crest in 2-foot increments with stop logs over project life to maintain 50% trap efficiency. Degrade training levees. Reconstruct training levees adjacent to west perimeter levee to allow maximum utilization of all land within the basin. Purchase in fee the 3,600 acres within the settling basin and establish a wildlife refuge. Operate basin in a dual capacity of sediment control and wildlife enhancement. Annually excavate about 50,000 cubic yards from basin for use by local topsoil distributors and maximum quantities for other uses as demand is established over project life.	No action undertaken by Federal Government for sediment control or erosion reduction through structural or non-structural measures.
II. PLAN EVALUATION			
A. Contributions To Planning Objectives			
1. Flood Control	Intercept 50% of the 1.2 million cubic yards of sediment that, on the average, annually flow into the settling basin, thus maintaining Yolo Bypass floodflow capacity.	Same as previous alternative except project life could be extended if substantial demands are established for future sediment excavation.	Deposition of Cache Creek sediments in the Yolo Bypass will, on an increasing basis impair the capability of that unit of the Sacramento River Flood Control Project to convey design floodflows.
2. Sediment Control	Intercept a major portion of sediment that currently flows into Yolo Bypass, downstream ship channels, and San Francisco Bay, thus reducing costly dredging operations.	Same as previous alternative except project life could be extended if substantial demands are established for future sediment excavation.	More frequent dredging of the Sacramento River ship channels and San Francisco Bay required to maintain their operating ability.
3. Environmental Enhancement	Provides for the establishment of a wildlife refuge over the entire settling basin.	Same as previous alternative except that up to 500 acres over a 5-year period will be excavated, causing temporary loss of vegetation on those lands. Large scale excavation at later date as demands are established could temporarily disrupt refuge operation.	- -
B. Relationship To National Accounts (System of Accounts)			No Federal or Non-Federal costs and no benefite.
1. NED			
a. Beneficial Impacts			
(1) Value of Increased Output of Goods and Services			- -
(a) Flood Control	$ 1,114,300	$ 1,114,300	
(b) Sediment Control	$ 268,000	$ 268,000	
(c) Recreation	$ 145,000	$ 145,000	
(d) Wildlife Refuge	$ 282,000	$ 282,000	
(e) Crop Depredation	$ 75,000	$ 75,000	
(f) NED Employment Benefits	$ 89,400	$ 81,700	
(2) Total Annual Benefits	$ 1,973,700	$ 1,966,000	- -
b. Adverse Impacts			
(1) Total Project First Costs	$12,682,000	$11,910,000	- -
(2) Total Annual Project Costs	1,020,000	966,600	- -
c. Net Benefits	953,700	999,400	
d. Benefit-To-Cost Ratio	1.9 to 1.0	2.0 to 1.0	

Index of Footnotes

Timing
1. Impact is expected to occur prior to or during implementation of the plan.
2. Impact is expected within 15 years following plan implementation.
3. Impact is expected in a longer time frame (15 or more years following implementation).

Uncertainty
4. The uncertainty associated with the impact is 50% or more.
5. The uncertainty is between 10% and 50%.
6. The uncertainty is less than 10%

Exclusivity
7. Overlapping entry, fully monetized in NED account.
8. Overlapping entry, not fully monetized in NED account.

Actuality
9. Impact will occur with implementation.
10. Impact will occur only when specific additional actions are carried out during implementation.
11. Impact will not occur because necessary additional actions are lacking.

Location of Impacts
12. Within the immediate planning area
13. Within the study area.
14. Within a larger area affected by the project.
15. Within the rest of the nation.

Measure of Impacts
16. Significant
17. Insignificant

Section 122
*Items specifically required in Section 122 and ER 1105-2-240.

TABLE D-2

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
SEDIMENT CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	RAISE SETTLING BASIN LEVEES (ENVIRONMENTAL QUALITY PLAN)	RAISE SETTLING BASIN LEVEES (NATIONAL ECONOMIC DEVELOPMENT PLAN, SELECTED PLAN)	NO ACTION
2. Environmental Quality			
a. Environmental Quality Enhanced			
(1) Enhance Aesthetics of Area Protected From Flooding	Reduce inundation area from potential floods by 100,000 plus acres. Levees will be seeded with grasses to restore original condition. *(2.6.7.9.13.16)*	Same as Previous Alternative.	- -
(2) Creation of Wildlife Area	3,600 acres of land, currently being used for agricultural purposes, would be converted to a wildlife refuge, significantly enhancing wildlife production in Sacramento Basin. *(1.6.7.9.14.16)*	Same as Previous Alternative.	- -
(3) Preservation of Open Space	- - -	Sediment to be excavated for fill from the basin would reduce demand in other areas, thereby reducing the amount of land scarring outside the settling basin. *(2.5.8.10.12.17)*	- -
(4) Improvement of Stream Aesthetics	Decrease by 335 acre-feet annually the amount of sediment passing into the Yolo Bypass and downstream ship channels, thereby decreasing turbidity. *(1.6.8.9.14.17)*	Same as Previous Alternative.	- -
b. Environmental Quality Degraded			
*(1) Vegetation Lost Due to Project Construction	250 acres of cropland permanently sacrificed to right-of-way. Temporary loss of 260 acres of vegetation to be used as a borrow site during construction. *(1.6.7.9.12.17)*	Same as Previous Alternative.	- -
(2) Wildlife	Insignificant disruption of local wildlife population during two season construction period. *(1.6.9.12.17)*	Same as previous alternative plus periodic disruption of local wildlife populations during annual sediment removal operations.	Continued lack of a fishery in lower Cache Creek. High turbidity levels in Yolo Bypass and downstream due to sediment inflow.
(3) Water Quality	No Effect	No Effect	No Significant Change.
(4) Air Quality	Minor affect of construction equipment exhaust during two season construction period. *(1.6.9.12.17)*	Same as Previous Alternative.	No Significant Change.
3. Social Well-Being			
a. Beneficial Impacts			
(1) Enhancement of Safety and Community Well-Being	Increase freeboard from three feet to five feet on levees surrounding the settling basin thus increasing the protection from flooding in that area. Increased levee height, which increases the storage capacity of the settling basin, decreases the amount of sediment allowed to flow into the Yolo Bypass thereby decreasing the chances of failure of Yolo Bypass Levees. *(2.6.9.13.16)*	Same as previous alternative but to a greater extent because of the annual sediment removal operations.	- -
*(2) Displacement of People	Periodic evacuation during periods of flooding would be reduced. *(2.6.9.13.17)*	Same as Previous Alternative.	- -
*(3) Improvement of Community Cohesion	Reduce threat of failure of Yolo Bypass levees that would cause widespread flood damage and possible loss of life. *(2.6.9.14.16)*	Same as previous alternative but to a greater extent.	- -
(4) Enhancement of Health	Reduce contamination of local water supply by floodwaters. *(2.6.13.16)*	Same as Previous Alternative.	- -
(5) Transportation	Decrease by 240 acre-feet annually the amount of sediment allowed to deposit in the Sacramento River shipping channel and the San Francisco Bay. *(1.6.7.9.14.16)*	Same as previous alternative plus potentially decrease road construction costs by making available inexpensive fill material.	- -
(6) Improvement of Leisure Activities	Creation of a wildlife refuge over the settling basin will produce an estimated 46,000 recreation user days annually for hunting, fishing, camping and wildlife observation. *(1.5.10.13.16)*	Same as Previous Alternative.	Cache Creek "white water" boating would increase. Recreation facilities will be developed to handle future use.
(7) Improvement of Public Facilities	Wildlife refuge establishment would restore area to relatively natural state, resulting in a long-term aesthetic increase. *(1.6.9.12.16)*	Same as Previous Alternative.	- -
b. Adverse Impacts			
(1) Noise	Minor effect due to construction equipment during two-season construction period. *(1.6.12.17)*	Same as previous alternative plus during annual sediment removal operations.	Noise would increase corresponding to population, industrial, and commercial development.

Index of Footnotes

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Uncertainty
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5. *The uncertainty is between 10% and 50%.*
6. *The uncertainty is less than 10%.*

Exclusivity
7. *Overlapping entry, fully monetized in NED account.*
8. *Overlapping entry, not fully monetized in NED account.*

Actuality
9. *Impact will occur with implementation.*
10. *Impact will occur only when specific additional actions are carried out during implementation.*
11. *Impact will not occur because necessary additional actions are lacking.*

Location
12. *Within the immediate planning area.*
13. *Within the study area.*
14. *Within a larger area affected by the project.*
15. *Within the rest of the nation.*

Measure of Impacts
16. *Significant*
17. *Insignificant*

Section 122
**Items specifically required in Section 122 and ER 1105-2-240.*

TABLE D-2

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS
SEDIMENT CONTROL ALTERNATIVE PLANS
(CONTINUED)

ALTERNATIVES	RAISE SETTLING BASIN LEVEES (ENVIRONMENTAL QUALITY PLAN)	RAISE SETTLING BASIN LEVEES (NATIONAL ECONOMIC DEVELOPMENT PLAN, SELECTED PLAN)	NO ACTION
*(2) Community Cohesion	- - -	- - -	No action will result in continued flood damage and possible loss of life.
*(3) Displacement of People	Three relocations necessary as a result of project construction. *(1,6,12,17)*	Same as Previous Alternative.	No action will result in continued evacuation of threatened residences during floods.
(4) Health	No Effect	No Effect	Contamination of local water supply during floods will remain a possibility.
(5) Transportation	No Effect	No Effect	Channel meander and continued erosion would threaten existing and future transportation systems by undermining bridge piers and abutments, as well as travel ways themselves.
(6) Leisure Activities	Existing private hunting clubs in settling basin would be abolished with establishment of a wildlife refuge. *(1,d,8,9,12,14)*	Same as Previous Alternative.	- -
(7) Public Facilities	Temporary aesthetic loss due to construction scars. *(1,d,9,12,17)*	Same as previous alternative plus scarring of land annually for sediment removal operations.	Increased residential development would destroy some "natural" aesthetic value. Continued channel erosion and gravel mining operations would continue to deteriorate the riparian appearance of Cache Creek.
(8) Historic and Archeologic	Wintun and Pomo Indian archeologic sites known to exist throughout the Cache Creek Basin could be disturbed by project construction. Levees would be built, however, from recently deposited sediment. A more complete archeological survey of the area would be made prior to congressional authorization of the project. *(1,5,13,17)*	Same as Previous Alternative.	Known archeologic resources in lower basin may be lost to continued erosion and development such as land leveling and urban buildup.
4. Regional Development			
a. Beneficial Impacts			
*(1) Value of Increased Income	$8,000 to $10,000 annually rebated under revenue sharing agreement when lands are taken for national wildlife refuge. Increased retail sales during two-year construction period would increase local tax revenue by about $3,900. Additional retail sales expected due to activity associated with refuge management. *(1,d,8,9,13,14)*	Same as previous alternative plus additional retail sales expected due to activity associated with annual sediment removal operations.	Higher developed land uses would raise property values, and thus tax revenues.
*(2) Quantity of Increased Employment	Estimated 90 workers would be acquired from the local labor force during the two-year construction period. Increased activity associated with outdoor recreation could favorably affect local employment. *(1,5,8,9,13,16)*	Same as previous alternative plus annual sediment removal operations would favorably affect local mining operators.	- -
*(3) Increased Business and Industrial Activity	Local retail sales increased $1,050,000 during construction. Local recreation-oriented business should increase. *(1,5,8,9,12,16)*	Same as previous alternative plus commercial soil mining operations effectively serviced by soil trapped within the basin.	- -
(4) Land Use	No Effect	Reduction in crop depredation on lands outside the settling basin.	- -
b. Adverse Impacts			
(1) Value of Income Lost	3,600 acres taken from county tax rolls would decrease county revenues by $90,000 annually. *(1,d,8,9,12,16)*	Same as Previous Alternative.	Lands sacrificed to continued erosion will be lost to county tax rolls. Crop depredation from wildlife would continue to be a problem.
(2) Employment/Labor Force	No Effect	No Effect	Employment in agriculture is expected to decline, with high growth rate in local government, finance, services, trade, construction, and manufacturing.
(3) Agricultural Activity	No Effect	No Effect	Based on current water available, maximum irrigable acreage possible in sub-basin is 58,000 acres. New agricultural development would be subject to this restriction. Continued erosion in Cache Creek would cause further loss of agricultural land.
(4) Land Use	250 acres of agricultural land lost to levee construction and an additional 260 acres temporarily taken from crop production to serve as a borrow area. *(1,6,7,9,12,17)*	Same as Previous Alternative.	- -

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Actuality
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Location of Impacts
12. *Within the immediate planning area.*
13. *Within the study area.*
14. *Within a larger area affected by the project.*
15. *Within the rest of the nation.*

Measure of Impacts
16. *Significant*
17. *Insignificant*

Section 122
**Items specifically required in Section 122 and ER 1105-2-240.*

TABLE D-2

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS

SEDIMENT CONTROL ALTERNATIVE PLANS

(CONTINUED)

ALTERNATIVES	RAISE SETTLING BASIN LEVEES (ENVIRONMENTAL QUALITY PLAN)	RAISE SETTLING BASIN LEVEES (NATIONAL ECONOMIC DEVELOPMENT PLAN, SELECTED PLAN)	NO ACTION
C. Plan Response to Associated Evaluation Criteria			
1. Acceptability	High	High	Low
2. Stability	High	High	Low
III. IMPLEMENTATION RESPONSIBILITY			
A. Corps of Engineers	Design, prepare detailed plans and specifications for, and construct project. Provide all costs of lands and initial facilities for wildlife refuge.	Same as Previous Alternative	- -
B. U.S. Fish & Wildlife Service	Provide all costs for future facilities for wildlife refuge. Operate and maintain refuge throughout project life in a manner compatible with sediment control.	Same as Previous Alternative	- -
C. State of California	Provide all costs for lands, easements, rights-of-way, and relocations attributable to sediment control. Operate and maintain project in a manner compatible with refuge management.	Same as previous alternative, plus arrange for periodic stockpiling and annual dispersal of 50,000 cubic yards of sediment. Actively seek other means to disperse sediment over project life.	- -

Index of Footnotes

Timing

1. *Impact is expected to occur prior to or during implementation of the plan.*
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Uncertainty

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Location of Impacts

12. *Within the immediate planning area.*
13. *Within the study area.*
14. *Within a larger area affected by the project.*
15. *Within the rest of the nation.*

Measure of Impacts

16. *Significant*
17. *Insignificant*

Section 122

**Items specifically required in Section 122 and ER 1105-2-240.*

TABLE D-3
ECONOMICS OF ALTERNATIVES CONSIDERED FURTHER

ALTERNATIVE	FIRST COST (Dollars)				ANNUAL COSTS (Dollars)			ANNUAL BENEFITS (Dollars)							BENEFIT-COST RATIO
	CONSTRUCTION	LANDS AND RELOCATIONS	RECREATION FACILITIES	TOTAL	MAINTENANCE, OPERATION AND REPLACEMENT	FLOOD ZONING	TOTAL**	FLOOD CONTROL	SEDIMENT CONTROL	WILDLIFE ENHANCEMENT	RECREATION	CROP DEPREDATION	NED EMPLOYMENT BENEFITS	TOTAL	
FLOOD CONTROL															
1. Flood proofing future facilities						78,800	78,300	242,100						242,100	3.1 to 1.0
2. Enlarge Clear Lake outlet channel	5,916,000	2,760,000		8,676,000	11,675		587,000	1,170,200***					56,400	1,226,600	2.1 to 1.0
3. Enlarge Clear Lake outlet channel and bypass Selected Plan	3,740,000	2,310,000		6,050,000	11,400		413,000	1,170,000***					35,700	1,205,900	2.9 to 1.0
4. Enlarge Clear Lake outlet channel and bypass NED Plan	3,565,000	2,310,000		5,875,000	7,700		397,600	1,170,200***					34,000	1,204,200	3.0 to 1.0
5. Enlarge Clear Lake outlet channel modified bypass and Anderson Marsh EQ Plan	4,807,000	2,517,000*		7,324,000	9,400		495,900	1,170,200***					45,900	1,216,100	2.5 to 1.0
6. No action															
SEDIMENT CONTROL															
1. Raise settling basin levees and establish a wildlife refuge EQ Plan	8,992,000	3,130,000	560,000	12,682,000	144,100		1,020,000	1,114,300	268,000	282,000	145,000	75,000	89,400	1,973,700	1.9 to 1.0
2. Raise levees, establish a refuge and excavate settling basin NED and Selected Plans	8,220,000	3,130,000	560,000	11,910,000	144,100		966,600	1,114,300	268,000	282,000	145,000	75,000	81,700	1,966,000	2.0 to 1.0
3. Raise levees and excavate settling basin with agriculture	8,220,000	3,130,000		11,350,000	19,100		626,000****	1,114,300	268,000				81,700	1,464,000	2.3 to 1.0
4. No action															

*212,000 of this amount is for the purchase of Anderson Marsh lands.

**Includes interest and amortization over 100 years for flood control and 50 years for sediment control.

***Includes 129,600 by requiring future development to flood proof to pre-project as opposed to post-project 100-year flood plain elevation.

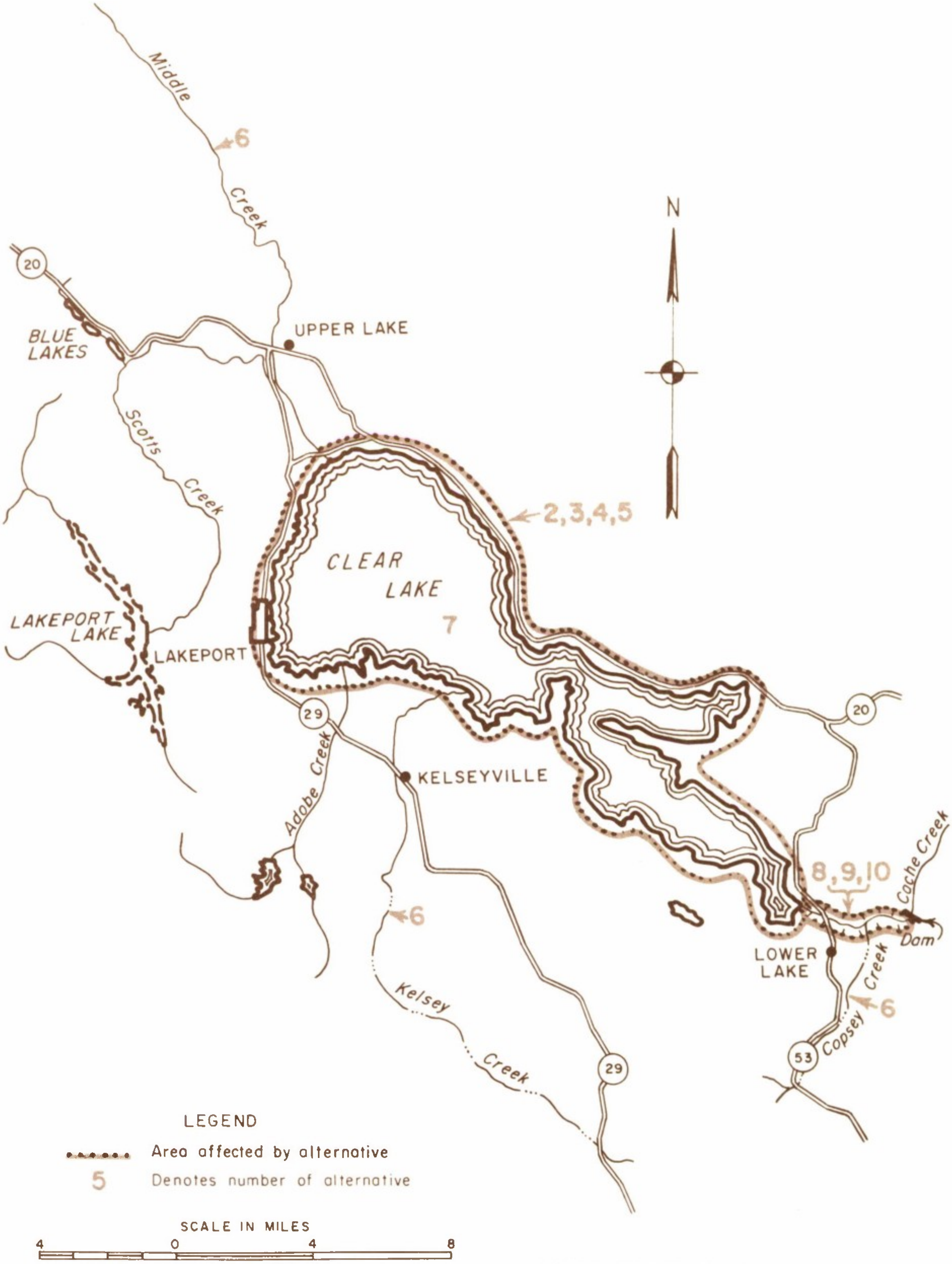
****Has been reduced by 177,000 due to revenue obtained from leasing for agricultural production.

TABLE D-4

FEDERAL AND NON-FEDERAL COSTS OF ALTERNATIVES CONSIDERED FURTHER*

ALTERNATIVE	FIRST COST *(Dollars)*		
	FEDERAL	NON-FEDERAL	TOTAL
FLOOD CONTROL			
1. Flood proofing future facilities	-	-	-
2. Enlarge Clear Lake outlet channel	5,916,000	2,760,000	8,676,000
3. Enlarge Clear Lake outlet channel and bypass (Selected Plan)	3,740,000	2,310,000	6,050,000
4. Enlarge Clear Lake outlet channel and bypass (NED Plan)	3,565,000	2,310,000	5,875,000
5. Enlarge Clear Lake outlet channel, modified bypass and Anderson Marsh (EQ Plan)	5,019,000	2,305,000	7,324,000
6. No action			
SEDIMENT CONTROL			
1. Raise settling basin levees and establish a wildlife refuge (EQ Plan)	10,402,000	2,280,000	12,682,000
2. Raise levees, establish a refuge and excavate settling basin (NED and Selected Plan)	9,630,000	2,280,000	11,910,000
3. Raise levees and excavate settling basin (with agriculture)	8,220,000	3,130,000	11,350,000
4. No action			

*Cost sharing is based upon traditional requirements and does not reflect the President's recent water policy.



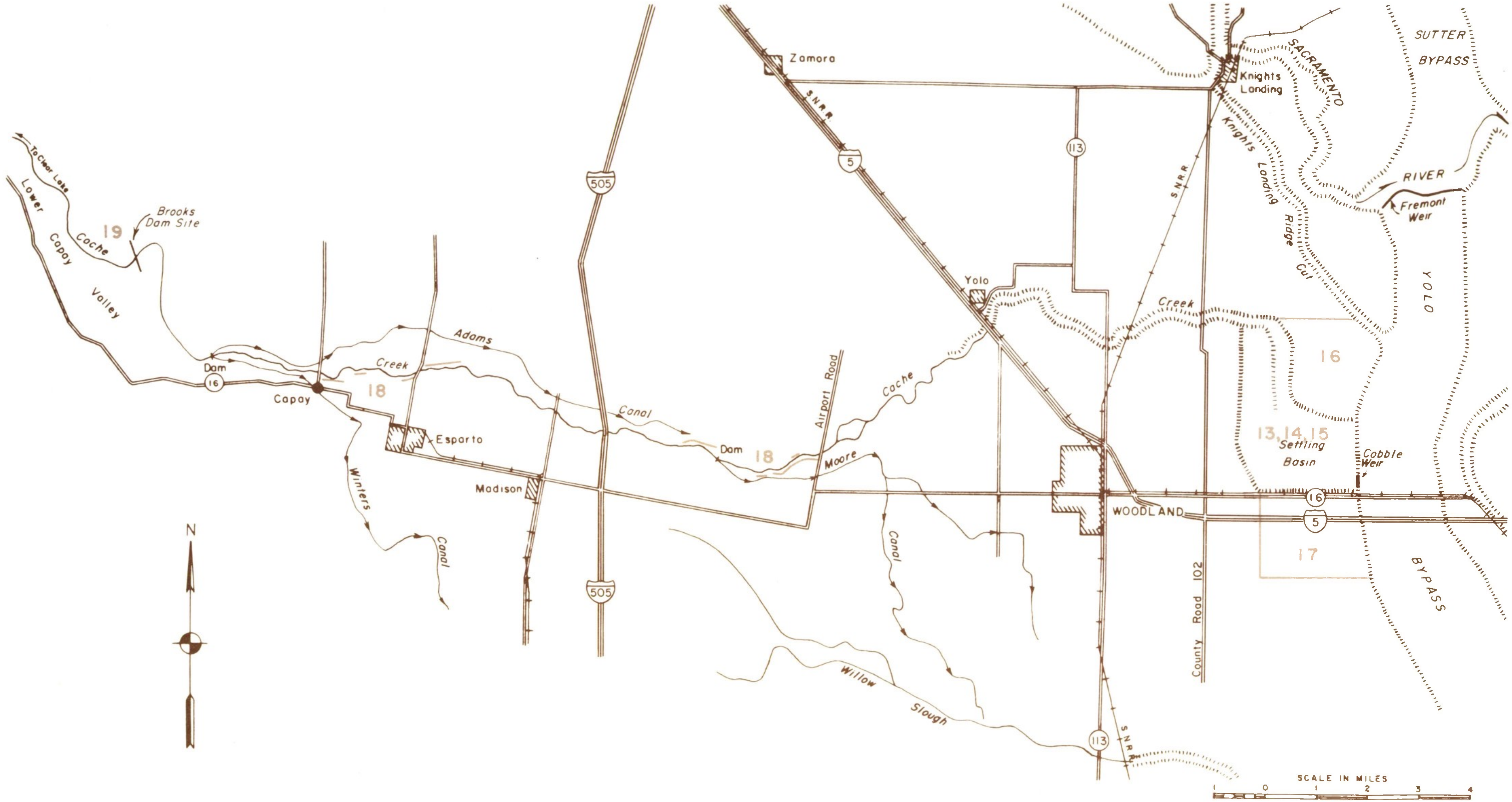
CACHE CREEK BASIN, CALIFORNIA

UPPER BASIN ALTERNATIVE PLANS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

AUGUST 1977

APPENDIX I PLATE D-1



LEGEND

Area affected by alternative

13 Denotes number of alternative

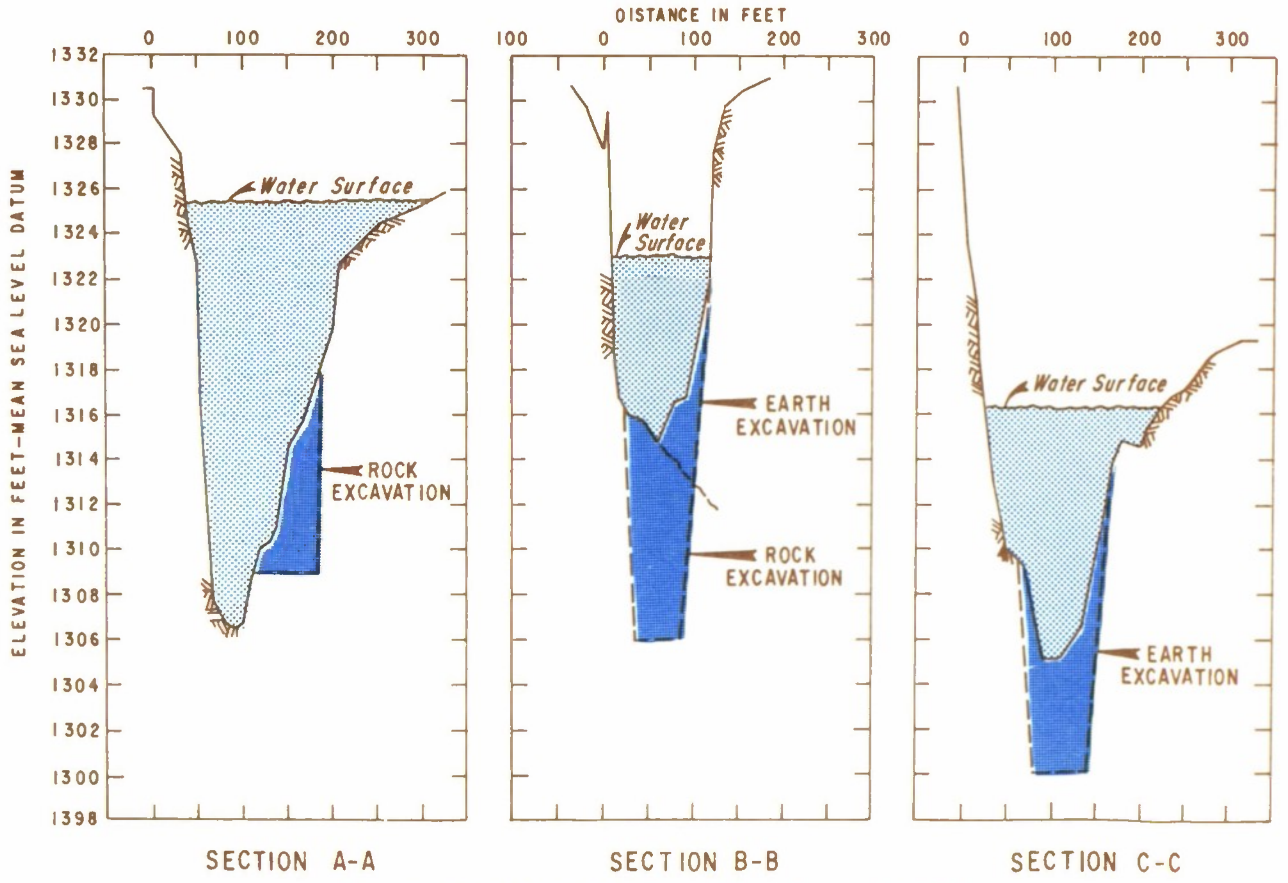
CACHE CREEK BASIN, CALIFORNIA

LOWER BASIN ALTERNATIVE PLANS

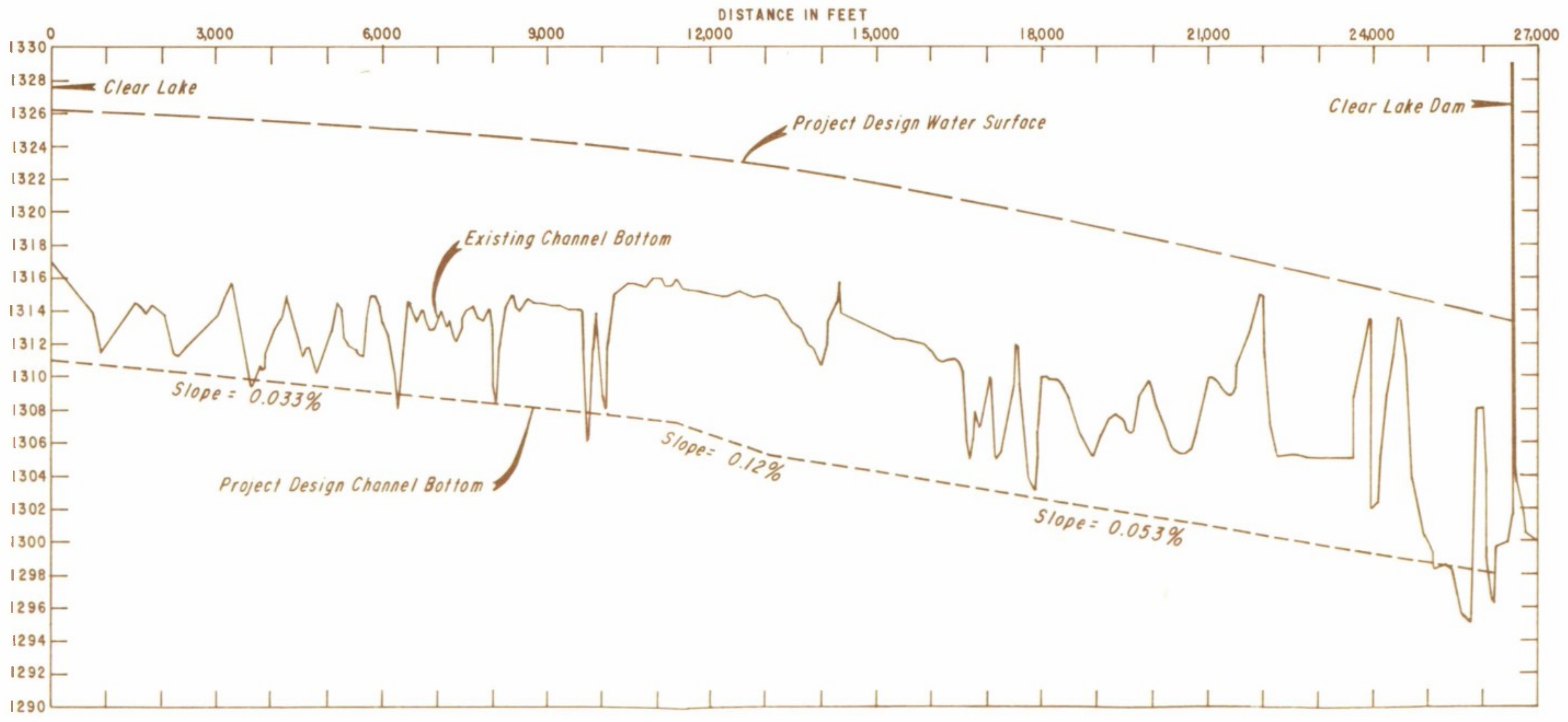
SACRAMENTO DISTRICT, CORPS OF ENGINEERS

AUGUST 1977

APPENDIX I PLATE D-2



EXISTING CHANNEL TYPICAL CROSS SECTIONS



PROFILE CLEAR LAKE OUTLET CHANNEL

COURT DECREES AFFECTING CLEAR LAKE OPERATION

1. Gopcevic Decree (1920)
   a. Maximum Clear Lake stage cannot exceed 9.00' on Rumsey Gage at Lakeport at any time. Stages between 7.56' and 9.00' are permitted for up to 10 successive days for temporary floodwater storage.
   b. Minimum Clear Lake stage set at zero on Rumsey Gage. In determining releases from the lake, irrigation, evaporation, and other losses must be included.
   c. Prohibits any alteration of the outlet channel except that necessary to carry out the provisions of the decree.
2. Bemmerly Decree (1940)
   a. Prohibits any widening, deepening, or enlarging of the Clear Lake Outlet Channel that could increase the flow from Clear Lake into Cache Creek.

PROPOSED CLEAR LAKE FLOOD OPERATION CRITERIA

The outlet channel will be operated so as to reduce stages at Clear Lake as much as possible without causing flows at Rumsey in the range above 20,000 c.f.s. to exceed the flows which would occur under present conditions. This will be accomplished by releasing at the project channel capacity as long as flows at Rumsey are not projected to exceed 20,000 c.f.s. and by controlling releases from Clear Lake to the present outlet capacity for the corresponding stage when flows at Rumsey are projected to exceed 20,000 c.f.s.

LEGEND

Existing channel

Proposed enlarged channel

SCALE IN FEET

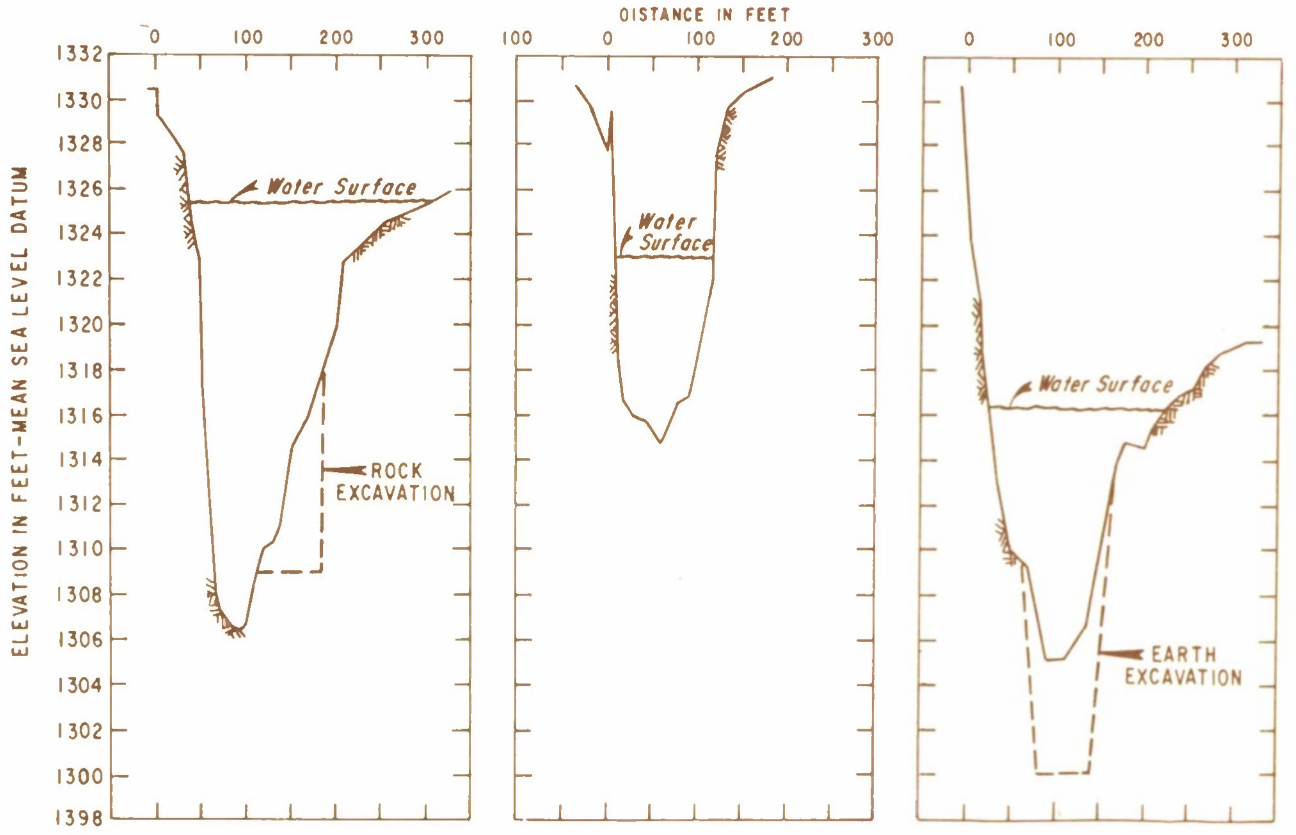
1000 0 1000 2000

CACHE CREEK BASIN, CALIFORNIA

ENLARGE CLEAR LAKE OUTLET CHANNEL

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

APPENDIX I PLATE D-3

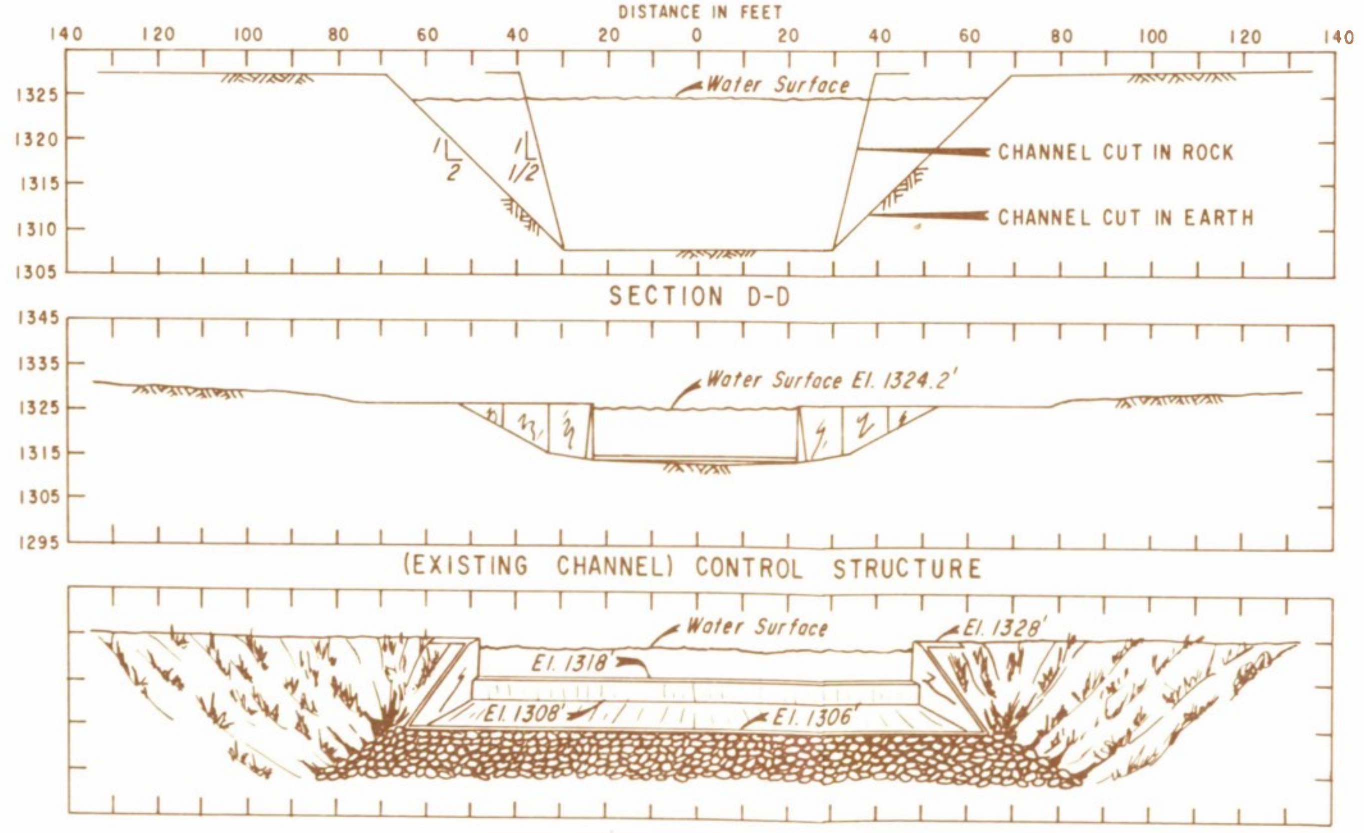


SECTION A-A

SECTION B-B

SECTION C-C

EXISTING CHANNEL TYPICAL CROSS SECTIONS



SECTION D-D

(EXISTING CHANNEL) CONTROL STRUCTURE

BYPASS WEIR

BYPASS CHANNEL SECTIONS AND STRUCTURES

COURT DECREES AFFECTING CLEAR LAKE OPERATION

1. Gopcevic Decree (1920)
   a. Maximum Clear Lake stage cannot exceed 9.00' on Rumsey Gage, at Lakeport at any time. Stages between 7.56' and 9.00' are permitted for up to 10 successive days for temporary floodwater storage.
   b. Minimum Clear Lake stage set at zero on Rumsey Gage. In determining releases from the lake, irrigation, evaporation, and other losses must be included.
   c. Prohibits any alteration of the outlet channel except that necessary to carry out the provisions of the decree.
2. Bemmerly Decree (1940)
   a. Prohibits any widening, deepening, or enlarging of the Clear Lake Outlet Channel that could increase the flow from Clear Lake into Cache Creek.

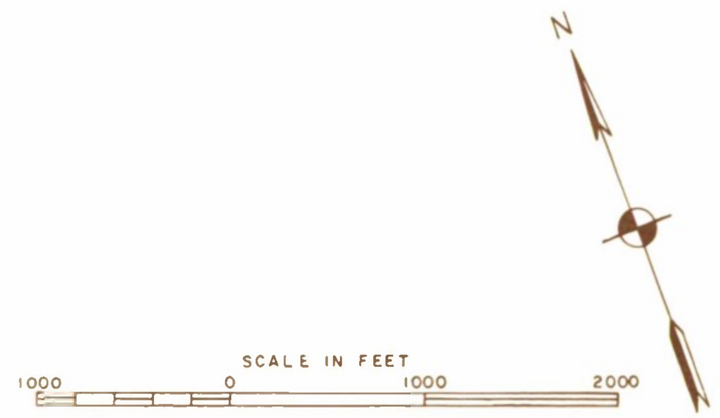
PROPOSED CLEAR LAKE FLOOD OPERATION CRITERIA

The outlet channel will be operated so as to reduce stages at Clear Lake as much as possible without causing flows at Rumsey in the range above 20,000 c.f.s. to exceed the flows which would occur under present conditions. This will be accomplished by releasing at the project channel capacity as long as flows at Rumsey are not projected to exceed 20,000 c.f.s. and by controlling releases from Clear Lake to the present outlet capacity for the corresponding stage when flows at Rumsey are projected to exceed 20,000 c.f.s.

LEGEND

Existing channel

Proposed enlarged channel and bypass

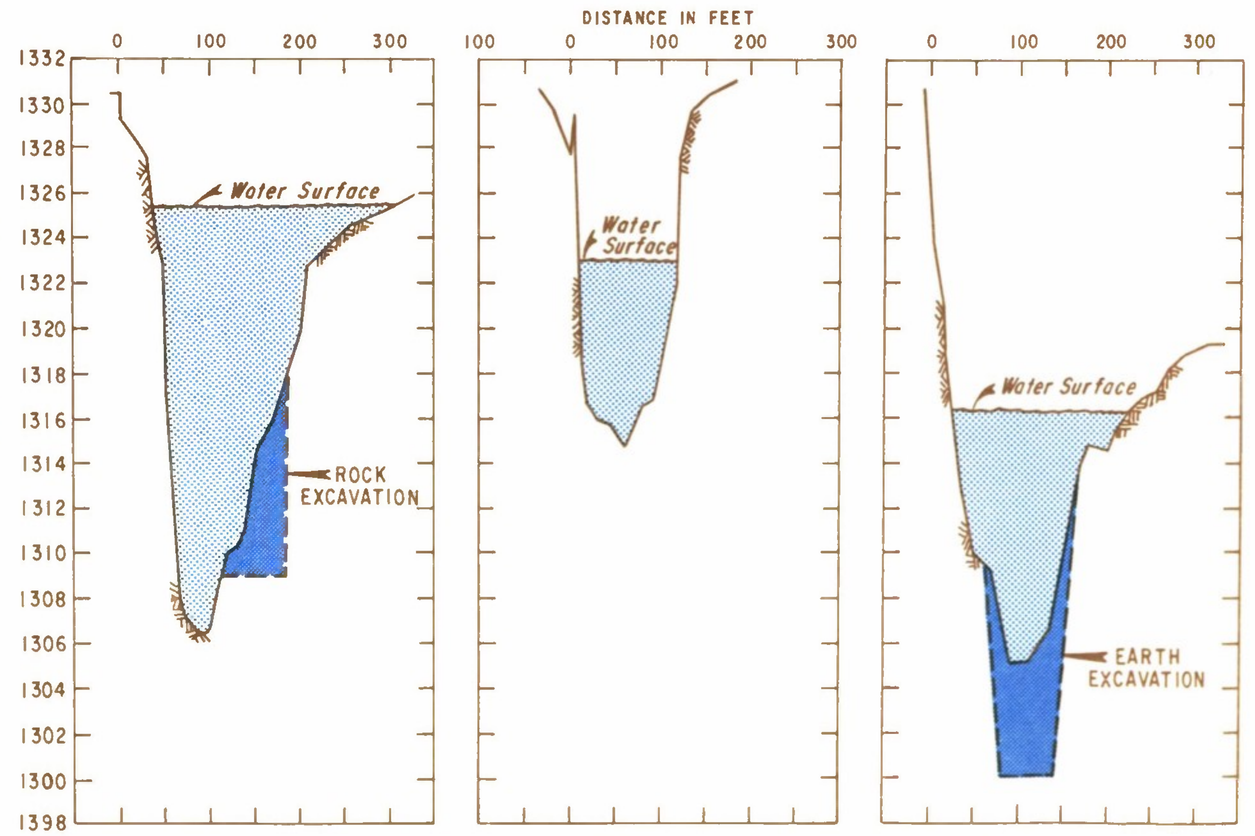


CACHE CREEK BASIN, CALIFORNIA

ENLARGE CLEAR LAKE
OUTLET CHANNEL AND BYPASS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

APPENDIX I PLATE D-4

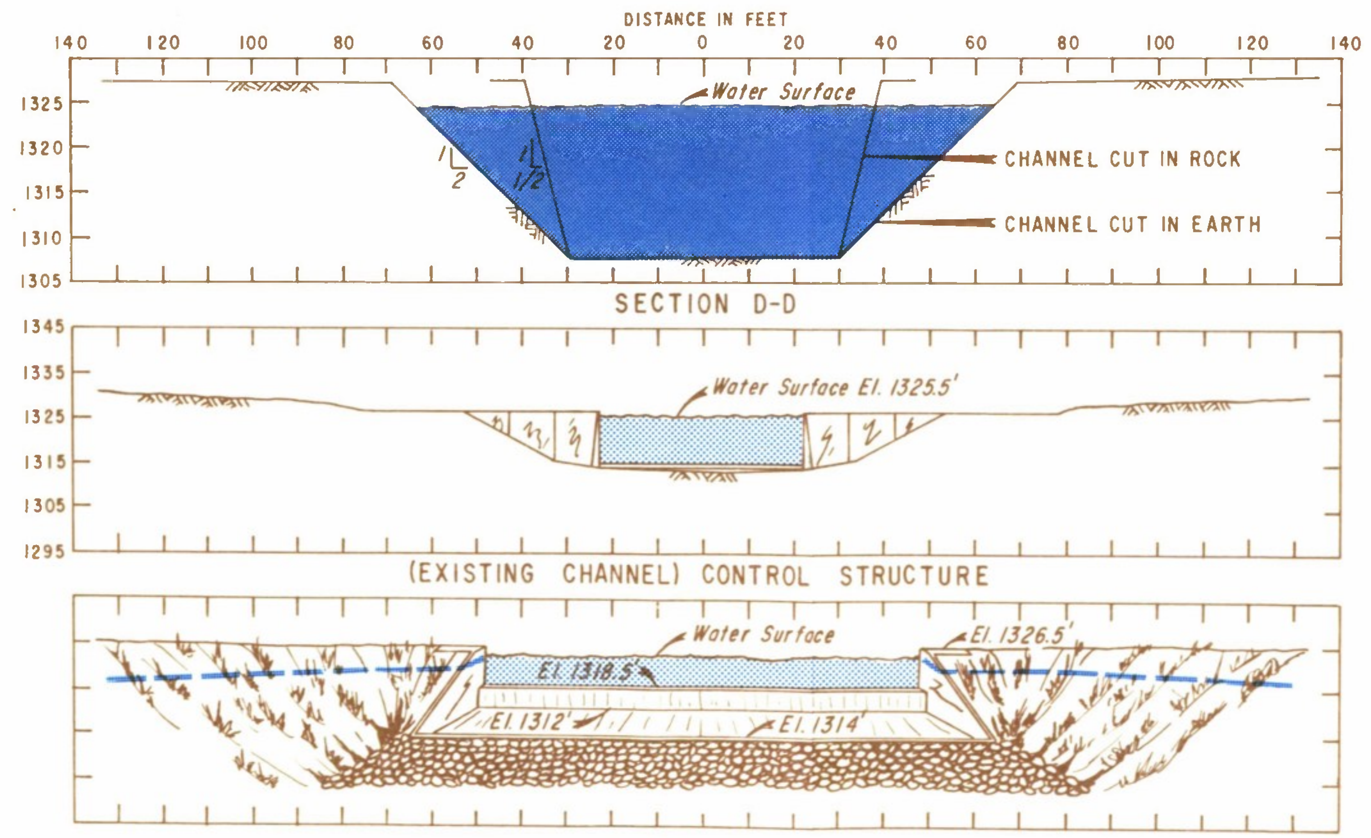


SECTION A-A

SECTION B-B

SECTION C-C

EXISTING CHANNEL TYPICAL CROSS SECTIONS



SECTION D-D

(EXISTING CHANNEL) CONTROL STRUCTURE

BYPASS WEIR

BYPASS CHANNEL SECTIONS AND STRUCTURES

COURT DECREES AFFECTING CLEAR LAKE OPERATION

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   a. Prohibits any widening, deepening, or enlarging of the Clear Lake Outlet Channel that could increase the flow from Clear Lake into Cache Creek.

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LEGEND

Existing channel

Proposed enlarged channel and bypass

N

SCALE IN FEET

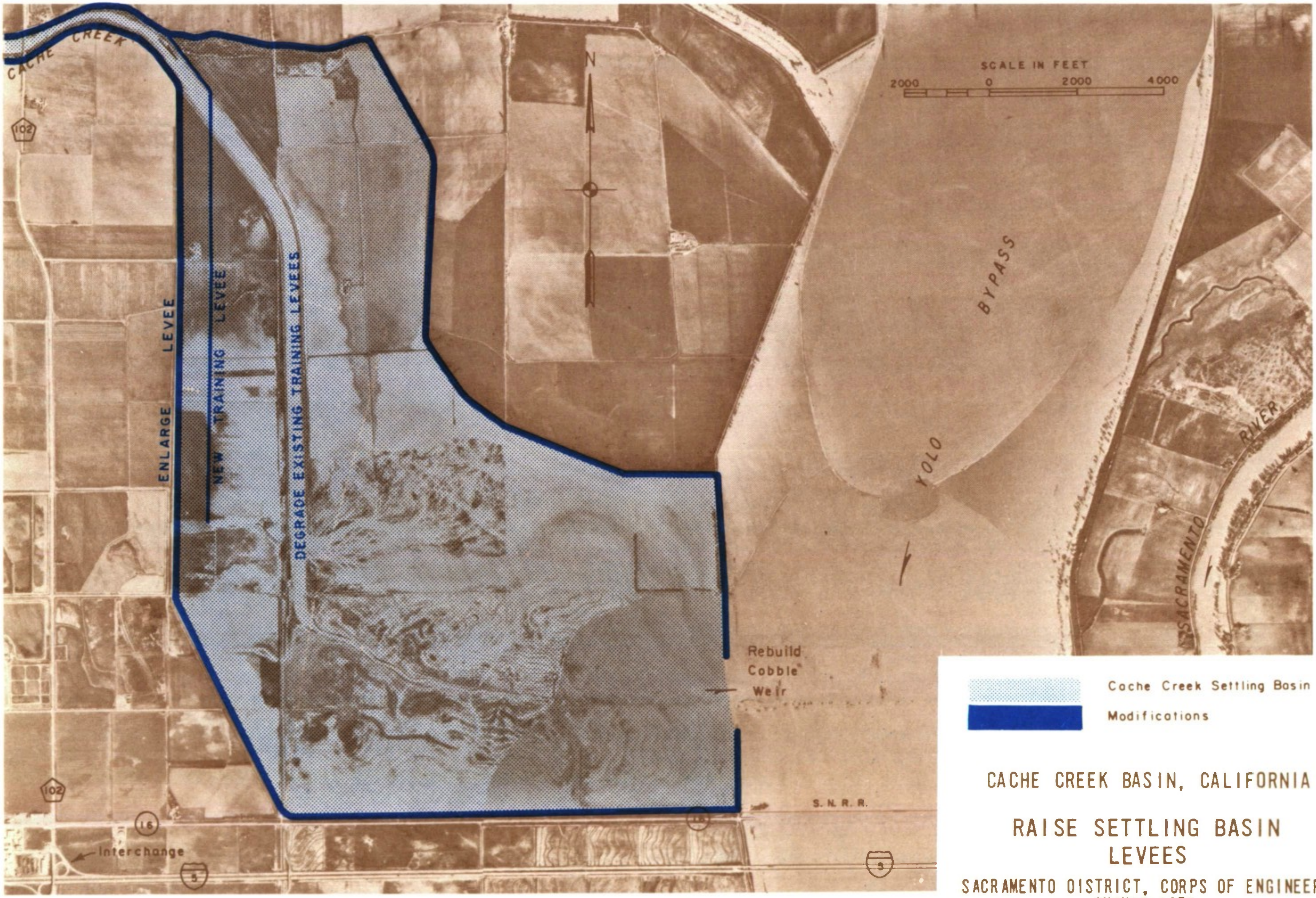
1000 0 1000 2000

CACHE CREEK BASIN, CALIFORNIA

ENLARGE CLEAR LAKE
OUTLET CHANNEL AND MODIFIED BYPASS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

APPENDIX I PLATE D-5

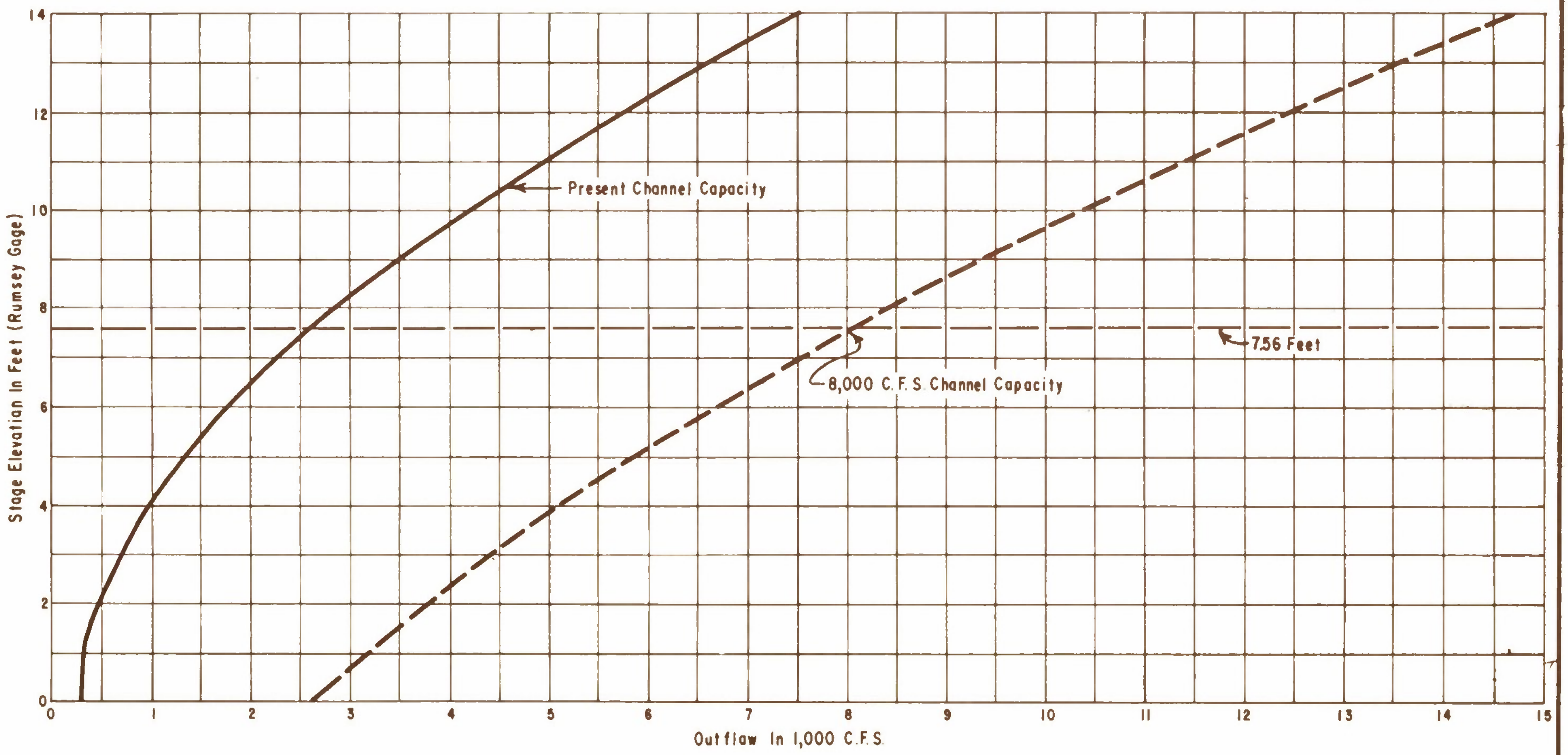


CACHE CREEK BASIN, CALIFORNIA

RAISE SETTLING BASIN
LEVEES

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

APPENDIX I PLATE O-6



CACHE CREEK BASIN, CALIFORNIA

CLEAR LAKE OUTLET CHANNEL
RATING CURVES

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

SECTION E

THE SELECTED PLANS

THE SELECTED PLANS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

SECTION E

THE SELECTED PLANS

1. This section contains a comprehensive discussion of the selected plans which were identified and analyzed in the preceding section. The plans are described under the headings Upper Basin (Clear Lake) and Lower Basin (Cache Creek). The purpose of Section E is to present adequate information so that the overall scope of each plan may be readily understood and visualized. Included are generalized descriptions of plan components and their functions and interrelationships and significant design, construction, and operation and maintenance aspects. Also, accomplishments of the plans are discussed. Environmental, cultural, social, and economic effects of the selected plans are discussed in detail in the Environmental Statement, Appendix 4, and summarized in tables 1 and 2, Section D.

Upper Basin (Clear Lake)

Plan Description

2. The plan that would best satisfy the flood control requirements in the upper Cache Creek Basin is shown on plate E-1. This plan consists of widening and/or deepening 3.3 miles of the existing 5-mile-long Clear Lake Outlet Channel to a capacity of 8,000 cubic feet per second (cfs) at a Clear Lake stage of 7.56 feet on the Rumsey gage at Lakeport (1326.21 feet, m.s.l. datum) and constructing a 1.1-mile-long bypass channel around the highly developed portion of the existing channel. Also, future development would be required to flood proof or otherwise construct above the elevation of the preproject 100-year flood plain. Releases from Clear Lake would be controlled by a modified operation of Clear Lake Dam, which is currently operated for water supply and flood control by Yolo County.

Plan Accomplishments

3. The plan would primarily result in reducing flood damages to existing and future development on the rim of Clear Lake and increasing employment of the local labor force. Existing and potential urban areas and approximately 4,135 acres of existing and future agricultural areas would be protected from floods. A breakdown of the flood damage benefits is shown in Section F. Total estimated average annual flood

damage reduction benefits are achieved over the 100-year life of the project and total $1,170,200. Area redevelopment benefits totaling $35,700 annually would accrue to the local population that would be unemployed without project construction and maintenance activities. The enlarged outlet channel will permit a slight revision to the manner in which Clear Lake is now filled, thus helping to provide a more reliable source of irrigation water for use in Yolo and Lake Counties.

4. Enlargement of the outlet channel would affect the magnitude and duration of downstream flows. Routing of historical and synthetic flood events indicates that the proposed project would slightly reduce peak flows of infrequent floods downstream of Clear Lake Dam. However, for flows occurring more frequently, the project would increase peak flows downstream since the enlarged outlet channel would provide the capability to release flows of greater magnitude than can be released under existing conditions and would maintain the duration of these flows for longer periods of time. These larger flows would not increase flooding downstream of Clear Lake Dam since releases are based upon and governed by the nondamaging flow of 20,000 cfs at the town of Rumsey. Existing gravel mining operations in Cache Creek channel in Yolo County would also be unaffected by the change in flow regime. Extensive analysis has also shown that these larger flows of longer duration would have an insignificant effect on the existing erosion problems currently experienced in and adjacent to Cache Creek channel downstream of Clear Lake Dam. Studies conducted to reach this

conclusion were performed by the Hydrologic Engineering Center (HEC), using a modified version of the HEC-6 model, "Scour and Deposition in Rivers and Reservoirs." Input to the computer model consisted of surveyed cross sections of the channel from Capay Dam upstream to Rumsey at one-half mile intervals, calibration of Manning's "n" values to match historic and calculated water surface profiles, sediment inflow and discharge data from U.S. Geological Survey Water Quality Records, and channel bed and bank gradation based on 13 representative samples obtained on 8 December 1976. Historical high flows of 1952, 1956, 1958, 1965, and 1970 were run, with no major scour or deposition identified. Plate E-6A illustrates the effect of the selected plan on the 1958 flood season at selected locations in the Cache Creek Basin. As a further test, runs were made of synthetic "super floods," where the five floods previously identified were routed "back-to-back," representing in excess of 350 successive days of high flow. However, as was shown in routing of the individual floods, the model results of the "super floods" indicate little or no difference in bed behavior between historical and project flow conditions.

5. These results can be explained at least in part by noting the difference in flow relationship with and without the project. As pointed out on page C-45 of Appendix 1, at Yolo approximately 90 percent of Cache Creek's average annual bed material transport occurs between flows of 1,500 to 11,000 cfs. Table C-21 on that page identifies a significant increase in the bed material transport rate of

the creek when flows exceed 2,000 to 3,000 cfs. During the flood of 1970, the number of days that the flow of Cache Creek at Rumsey exceeded 2,000 cfs would have been reduced from 47 to 27 with the project, a decrease of 43 percent. For the 1956, 1958, 1965, and 1970 floods, the average decrease in the number of "erosion days" where flows were decreased to less than 2,000 cfs with the project is 37 percent. In summary, the total volume of water for any particular storm runoff in Cache Creek is not changed with the project. A decrease of at least one-third in the number of days in which erosion will occur will be realized with the project and will reduce overall erosion. This benefit would, of course, be partially offset by increases in some peak flows. This change in flow regime is not of such significance that ground water conditions in Yolo county will be affected.

This conclusion was further verified as a result of a recommendation by Dr. John F. Kennedy, Director, Institute of Hydraulic Research, University of Iowa. Dr. Kennedy recommended that by comparing the time-duration of shear stress exerted on the streams fluvial boundary for both project and preproject conditions, a measure of the potential for bank erosion could be obtained. The 1970 flood was analyzed. This flood produced a peak discharge of 19,200 cfs with a total duration of 53.9 days under preproject conditions and a peak discharge of 17,200 cfs with a total duration of 40.6 days under project conditions. The

analysis showed a 1.4 percent decrease in the time duration of shear stress with project conditions. This difference is small and probably not within the limits of computational accuracy but further verifies that there will be no difference in the erosion characteristics of Cache Creek with and without the project. However, sedimentation gages will be installed during advanced engineering and design studies to provide additional data for analysis.

Effects of the Plan on the Environment

6. Primarily, the proposed plan would provide flood protection to homes, commercial developments, and agricultural crops encircling the Clear Lake rim, thus enhancing not only the quality of the human environment but the local economy as well. Although vegetation would be disturbed by enlargement of the existing channel, additional riparian vegetation would be planted, and new riparian vegetation would be created along the banks of the 1.1-mile-long bypass channel. The U.S. Fish and Wildlife Service by letter dated 26 July 1977 stated that it did not foresee the need to recommend any land acquisition for mitigative purposes. It further stated that this position had been coordinated with the California Department of Fish and Game. Results of Fish and Wildlife Service studies also showed that the more rapid drawdown of Clear Lake during flood periods would have no effect on Anderson Marsh because the project only increases releases when Clear Lake is above a stage of 7.56 feet, which is several feet above the elevation at which water enters the marsh. A cultural resources reconnaissance report was completed in accordance with Corps of

Engineers regulation, "Identification and Administration of Cultural Resources" (33 CFR 305). By letter dated 4 November 1977, the State Historic Preservation Officer stated he was impressed with the "professional quality" of the reconnaissance report. The environmental statement for this report is attached as Appendix 4. As required by the National Environmental Policy Act of 1969, the statement includes details of environmental, cultural, social, and economic effects of the selected plans. A summary of these effects is shown on Table 1, Section D, Summary of Economic-Environmental-Social Effects, Clear Lake Flood Control Alternative Plans.

Design

HYDROLOGY

7. Standard Project Storms. - The general standard project rainstorm precipitation was computed in accordance with procedures outlined in the Sacramento District's preliminary "Standard Project Rain-Flood Criteria Report-Sacramento-San Joaquin Valleys," dated April 1971. Storm precipitation was assumed to occur as rain on snow-free ground. Two standard project storms, one centered over the drainage area above Indian Valley Reservoir and the other over Clear Lake, were selected from several centerings investigated, because the first produced the most critical flood in the lower Cache Creek Basin and the second produced the highest discharge from Clear Lake. Concurrent storm amounts were calculated for all other subareas for each storm

centering. Table E-1 shows data used in the development of standard project storms (SPS) and concurrent storms (CS) for each subarea.

8. Unit Hydrographs. - Synthetic unit hydrographs used for computing standard project floods are identical to those applied in reconstitutions of historical flood hydrographs in Cache Creek Basin. The development of these unit hydrographs is described in Section C, paragraph 18. Pertinent basin and unit hydrograph data are shown on table C-4. Sample unit hydrographs are shown on plates E-7 and E-8.

9. Losses. - Constant loss rates of 0.064, 0.04, and 0.030 inches per hour, derived from analyses of historical events in Cache Creek Basin, were adopted for North Fork Cache Creek, Cache Creek local above Rumsey and Bear Creek, and Cache Creek below Rumsey, respectively, and constant loss rates ranging from 0.045 to 0.061 inches per hour were used in various areas above Clear Lake Dam for standard project rain flood computations. The minor changes in land use from present conditions and those projected for the year 2020 were found to have little significant effect upon the overall loss rates.

10. Base flow. - Base flow for standard project floods in Cache Creek Basin was determined to be equivalent to or greater than that observed

TABLE E-1

STANDARD PROJECT STORM PRECIPITATION

Subarea	D.A. (sq mi)	NAP (in.)	1/ Storm Type	1/ Storm Amount (in.)	2/ Storm Type	2/ Storm Amount (in.)
North Fork Cache Creek Indian Valley Reservoir Index Point 4	121.0	41.3	SPS	18.54	CS	14.79
North Fork Cache Creek Local between Index Points 5 and 4	76.0	35.5	CS	15.64	CS	13.76
Clear Lake at the riffles Index Point 1	504.0	32.7	CS	14.00	SPS	15.06
Copsey Creek near Lower Lake - Index Point 2	13.2	30.9	CS	14.51	CS	12.45
Cache Creek Local between Index Point 3 and 2, 1	10.8	27.0	CS	11.76	CS	10.31
Bear Creek near Rumsey Index Point 6	100.0	29.9	CS	11.45	CS	11.45
Cache Creek Local between Index Points 7 and 6, 5, 3	127.3	29.0	CS	11.33	CS	10.89
Cache Creek Local between Index Points 8 and 7	91.7	25.9	CS	10.07	CS	10.07
Cache Creek Local between Index Points 9 and 8	34.3	27.7	CS	10.44	CS	10.44
Cache Creek Local between Index Points 10 and 9	60.7	18.7	CS	4.78	CS	4.78

1/ SPS centered over drainage area above Indian Valley Reservoir.
2/ SPS centered over Clear Lake.

during past large floods for North Fork Cache Creek near Lower Lake and Bear Creek near Rumsey. For all other areas baseflow could not be determined accurately, because of regulation of outflows from Indian Valley Reservoir and Clear Lake at Clear Lake Dam. Baseflow was assumed to be zero in areas below the gages on North Fork Cache Creek and Bear Creek, and below Clear Lake Dam.

11. Standard Project Floods. - Standard project floods were computed using storms, unit hydrographs, and loss data discussed in preceding paragraphs and in the "Cache Creek Basin - Hydrology Office Report," dated May 1974. These floods reflect regulation of flows by Indian Valley Reservoir and Clear Lake Dam near Lower Lake. The resultant flood hydrographs, at the Grigsby Riffle index point for existing and project conditions of the 20-day standard project flood series for the storm centered over Clear Lake, are shown on plate E-11. In addition, plate E-11 shows the effect of the selected plan on the lower Cache Creek Basin for the standard project storm centered above Indian Valley Reservoir. Standard project flood hydrographs for the area below Capay are omitted because extensive gravel mining operations are continuously changing overbank and stream channel geometry and the amount of infiltration into the underlying aquifers. Therefore, accurate estimates of flood magnitudes cannot be determined for Cache Creek at Yolo.

12. <u>Frequency Analysis</u>. - Peak stage and flow frequency curves developed for Clear Lake, Cache Creek near Lower Lake, and Cache Creek above Rumsey were derived assuming the absence of the authorized Lakeport Lake project and are shown on plates E-10, E-9A, and E-9B, respectively. The preproject stage-frequency curves for Clear Lake and Cache Creek near Lower Lake are based on the historical records of annual peak stages. The project stage-frequency curve is based on the hypothetical operation of both Clear Lake and Indian Valley Reservoir for large historic floods and synthetic floods. Clear Lake was operated to reduce flood stages on the lake without causing flows at Rumsey to exceed those which would have occurred under preproject conditions in the range of flows above 20,000 cfs at Rumsey. This was accomplished by releasing up to the project outlet capacity when flows at Rumsey were below 20,000 cfs and by limiting outflows to preproject capacity when flows were above 20,000 cfs at Rumsey. Indian Valley Reservoir was operated in accordance with current prescribed procedures to control flows at Rumsey to 20,000 cfs or less. This procedure consists of reducing outflows to a nominal fish release during flood conditions. Since flood control operation of Indian Valley Reservoir has priority over operation of Clear Lake due to the fact that the reservoir is currently operated for flood control as prescribed by the Secretary of the Army, the additional outlet capacity at Clear Lake is used only when the sum of the Indian Valley release and uncontrolled flows at Rumsey is below 20,000 cfs. The project frequency curve at Cache Creek near Lower Lake is based on hypothetical operation of both

Clear Lake and Indian Valley Reservoir for large historic floods and synthetic floods. For nonflood years Clear Lake was operated based on the existing rule curve used for conservation operation of the lake. This curve requires a stage of 5.50 from 1 December through 10 January and a variable stage from 11 January until reaching the maximum stage of 7.56 on 15 March. The flow-frequency curves at Rumsey are based on the data developed for synthetic floods discussed above. The project and preproject curves are identical above 20,000 cfs since Indian Valley Reservoir operation uses all available flood release capability, and Clear Lake releases are based on preproject outlet capacity. Preproject curves below 20,000 cfs were developed by modifying historical flows at Rumsey to reflect the operation of Indian Valley Reservoir. Project curves were developed from the operation of Clear Lake according to the existing rule curve as discussed above.

HYDRAULIC DESIGN

13. Basis of Design. - Channel construction and associated works for the upper Cache Creek Basin are based on requirements resulting from hydraulic computations. The bottom width and invert gradient represent a balance among such factors as a nondamaging water surface in Clear Lake, real estate requirements, Clear Lake Dam outflow, and pleasure craft requirements of the local inhabitants adjacent to the outlet channel. The side slope of the channels would be 1 vertical on 2 horizontal in earth excavation and 1 vertical on .5 horizontal in rock

excavation. Riprap would be placed on the bypass channel side slopes at the entrance and, for a short distance, on the invert at the upstream end of the bypass channel. The proposed channel grades and invert are shown on plate E-4.

14. A 36-inch diameter concrete conduit (inverted siphon) would be constructed at the intersection of Seigler Creek and the bypass channel to insure flow in the creek between the bypass channel and the outlet channel. Flows exceeding the capacity of the conduit during flood periods would be spilled into the bypass channel.

15. Hydraulic computations indicate that when the flow in the existing channel just upstream of the bypass channel is 8,000 cfs (design flow) approximately 6,000 cfs would be diverted into the bypass channel. The remaining 2,000 cfs would continue to flow down the existing channel. For flows exceeding 8,000 cfs, the existing channel (parallel to the bypass channel) would carry less than under preproject conditions. At lower flows (flows of about 500 cfs), approximately two-thirds of the flow would be conveyed by the bypass channel and about one-third by the existing channel.

Foundations and Materials

16. Although extensive borings were not taken throughout the entire reach of the proposed project, borings were taken by the State of California at the time of construction of the State Highway bridge over

Clear Lake Outlet Channel. These borings, in addition to visual inspection of ground conditions such as exposed channel banks, provided the basis for modes of channel excavation. Further visual geologic inspection indicates that from the head of the bypass channel easterly to State Highway 53 the channel will be excavated from clayey silts and clayey sands of the Anderson Flat alluvium. From State Highway 53 easterly to Siegler Creek approaching Old Highway 53, the channel excavation will be in clayey silts and clayey sands of the Anderson Flat alluvium, clayey silts and clays of the Cache Creek formation, and Siegler Creek gravels, cobbles, and boulders. From Old Highway 53 for approximately 450 feet easterly, the channel will be excavated in massive, very hard durable andesite that is covered by a thin veneer of alluvium. The remainder of the channel will be excavated from clayey silts and clayey sands similar to the Anderson Flat alluvium with a slightly higher clay content and clayey silts and clayey sands of the Cache Creek formation. Local areas of opaline rock may be encountered in Cache Creek sediment through this reach. Materials encountered in the test borings for the State Highway 53 bridge across Cache Creek consisted of clay, silty clay, clayey silt, sandy silt, and gravel. Materials of the Anderson Flat alluvium, Siegler Creek sediments, and Cache Creek formation can be excavated with conventional earthmoving equipment. The Cache formation is a Pliocene-Pleistocene nonmarine sedimentary deposit composed of silts, gravels, and clays with beds of rhyolitic tuffaceous sand, marl limestone, and diatomite. It is weakly cemented but stands in near vertical banks along the creek. Local

excavation. Riprap would be placed on the bypass channel side slopes at the entrance and, for a short distance, on the invert at the upstream end of the bypass channel. The proposed channel grades and invert are shown on plate E-4.

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areas have been hydrothermally altered to form dark reddish-brown limonitic soils and opaline rock types. Some hard ripping or light blasting may be required in the areas containing opaline rock types within the Cache Creek formation. Excavation for that part of the channel founded in andesitic rock will be accomplished by drilling and blasting. The andesite will be stable on cut slopes of 1.0 vertical on 0.5 horizontal. Cut slopes in soils would be 1 vertical on 2 horizontal. Excavation in most reaches of the proposed enlargement of the existing channel can be accomplished with conventional earthmoving equipment. Some short segments will require hard ripping or drilling and blasting. The rock excavated from the channel can be used, with a minor amount of processing, for riprap for the channel sides and invert at the upstream end of the bypass channel. The test borings and rock locations are shown on plate E-1.

Rights-of-Way

17. Rights-of-way would be required for all new and enlarged channels, and maintenance rights-of-way would be required for the upper Cache Creek Basin. Easements will be obtained for spoil areas and access. The spoil area easement period would be 5 years. The total channel rights-of-way, 79 acres, would be acquired in fee title. The temporary spoil area easements would total 80 acres. Rights-of-way and easements would be provided by local interests.

Relocations and Modifications

18. In Upper Cache Creek, two new bridges would be constructed over the bypass channel at State Highway 53 and old Highway 53. Numerous utilities such as telephone, water, sewer, and powerlines would have to be relocated. Channel excavation would require relocation of several residences and docks along the existing channel. The above relocations and bridge construction are a local interest responsibility and would have to be accomplished prior to construction or concurrently with the channel improvement.

Construction

19. Following completion and approval of advance engineering and design studies, and assuming adequate funding, the Upper Basin portion of the project could be constructed in about 1-1/2 years at a cost of $6,050,000. Borrow material from excavation of existing and bypass channels would be spread over 80 acres of spoil area adjacent to the channel. Spoil areas would not be damaged and would be leased during the 5-year settlement period, during which time the deposited material would be naturally consolidated. Excavation would require fee purchase of 74 acres of agricultural land with creek frontage and 5.2 acres of residential property, with about 55 owners affected. In addition, permanent easements would be required over existing private roads for access during construction and subsequent maintenance. The Clear Lake

Dam meets current dam safety requirements and can be effectively operated under project conditions. Prior to construction of the project, more detailed inspection of the dam, including access, erosion, and debris control provisions, will be made to determine if minor modification will be necessary.

Operation and Maintenance

20. Annual operation and maintenance and replacement costs associated with the channel improvement project would be a non-Federal responsibility. The Yolo County Flood Control and Water Conservation District currently operates the Clear Lake Dam for water supply and flood control in accordance with provisions of the Gopcevic Decree. The District's operation would be modified in accordance with regulations prescribed by the Secretary of the Army. Average annual operation and maintenance costs for the enlarged channels, rock revetment, and siphon would total $1,000 over the 100-year project life. Most channel maintenance operations would be performed with watercraft, except within the diversion channel. Average annual replacement costs of $10,400 are estimated for replacement work at the project half-life, or after 50 years. Total average annual operation, maintenance, and replacement costs are $11,400.

Lower Basin (Cache Creek)

Plan Description

21. The best plan to achieve the desired degree of sediment control on Cache Creek and thus preserve the integrity of the Sacramento River Flood Control Project is shown on plate E-2 and would consist of the following:

a. Enlarging the existing perimeter levees of the Cache Creek Settling Basin an average of 12 feet to provide 50 years of sediment storage capacity and enlarging the existing project levees from the settling basin mouth upstream to County Road 102.

b. Reconstructing and enlarging the existing Cobble Weir.

c. Degrading the existing training levees and rebuilding them adjacent to the western perimeter levee to allow utilization of the entire basin for sediment deposition.

d. Purchasing in fee 3,600 acres of the existing settling basin and establishing a wildlife refuge.

e. Excavating 50,000 cubic yards of sediment annually for use by local topsoil distributors.

Plan Accomplishments

22. The major accomplishment of this plan would be entrapment of an average of 340 acre-feet of Cache Creek's heavy sediment load upstream of the Yolo Bypass over 50 years. Without this control, 15 percent of the total sediment load entering the settling basin, or about 100 acre-feet each year, is expected to deposit within the Yolo Bypass adjacent to the Cobble Weir. Although this deposition would not significantly decrease the agricultural productivity of about 2,100 acres of agricultural land in the bypass over which the sediment would deposit, it would inundate and render useless 435 acres of industrial sewage oxidation ponds owned by the city of Woodland and would cause a backwater effect which would encroach on the freeboard of the Yolo Bypass levees from Interstate 5 north to the Fremont Weir; on the Sacramento River levees from the Fremont Weir downstream to the Sacramento Weir; and on the Knights Landing Ridge Cut levees for their entire 6.8-mile length. The remaining 85 percent of the total sediment load from Cache Creek would continue downstream in the Yolo Bypass where portions would eventually deposit in the Sacramento River, the Sacramento River Deep Water Ship Channel, and the San Francisco Bay System and require periodic dredging. Other accomplishments of this plan are discussed below.

23. A National Wildlife Refuge within the settling basin, operated by the U.S. Fish and Wildlife Service, would be a valuable addition to the system of refuges in the Sacramento Basin. The U.S. Fish and Wildlife Service and California Department of Fish and Game indicate that such a refuge would help meet their objectives for wetland preservation in the Central Valley of California and also for additional refuges for migratory birds. Also, by improving waterfowl distribution, disease loss and crop depredation would be decreased. In addition, recreational consumptive uses such as hunting and fishing, as well as nonconsumptive uses such as environmental education, would increase. Some agricultural productivity on the 3,600 acres would continue but would be constrained by sediment and removal, refuge operation, and by the fact that only certain crops would be grown and a portion of these would have to be left for wildlife.

24. Provision for excavation of 50,000 cubic yards annually for use as topsoil would decrease storage requirements within the basin by about 1,550 acre-feet over the 50-year project life. This soil would serve as a source for the dwindling supply of this material in the Sacramento area. A study conducted by the University of California at Davis in November 1975, entitled "Cache Creek Basin Investigation, Cache Creek Settling Basin," established the demand of 50,000 cubic yards annually. Uses would be horticultural, such as landscaping. Material would be moved in small quantities (a truckload or two at a time) in a manner typical of topsoil sales in the Sacramento-Yolo County area.

Fee purchase of the settling basin lands would also allow sediment within the basin to be used in the future for structural embankment, improvement of agricultural soils, and other related uses. This extensive excavation is not possible at present; sediment cannot be removed because flowage easements alone are owned. Fee purchase would also negate the possibility of future litigation involving easements, a significant problem with today's conditions.

Effects of the Plan on the Environment

25. Control of Cache Creek sediment would decrease the threat of failure of the Sacramento River Flood Control Project. Creation of a wildlife refuge, although temporarily disrupting existing vegetation and wildlife during construction, would provide habitat for a greatly increased and diversified wildlife population. The U.S. Fish and Wildlife Service by letter dated 26 July 1977 stated that it did not foresee the need to recommend any land acquisition for mitigative purposes. It further stated that this position had been coordinated with the Califonria Department of Fish and Game. The environmental statement for this report is attached as Appendix 4. As required by the National Environmental Policy Act of 1969, the statement includes details of environmental, cultural, social, and economic effects of the selected plans. A summary of these effects is shown on Table D-2, Summary of Economic-Environmental-Social Effects, Sediment Control Alternative Plans.

Design

HYDROLOGY

26. Hydrologic characteristics of the Lower Cache Creek Basin are described in paragraphs 7 through 11.

Hydraulic Design

27. The proposed plan of improvement would provide 15,500 acre-feet of sediment storage capacity, based on a 50-year project life and a 50 percent sediment strap efficiency. To enable control of the desired 50 percent sediment trap efficiency throughout the life of the project, a concrete weir would be designed so that five 2-foot-high concrete lifts could be added above the initial weir crest as needed. The new weir would be 1,740 feet long and have the same effective flow width as the existing 1,540-foot-long weir due to losses through the new weir. The weir would be designed to handle a flow of 30,000 cfs.

28. The roughness factor (n value) used in hydraulic computations accounted for anticipated vegetative growth and earth dikes which will be a part of the proposed wildlife refuge. Existing settling basin levees would be raised an average of 12 feet for a total average height of 20 feet. Settling basin levees would be designed with 5 feet of freeboard above the water surface profile for the Cache Creek floodflow

of 30,000 cfs. Even though the project levees upstream of the settling basin are designed for a flow of 30,000 cfs, they are capable of conveying much larger flows. As discussed on page C-22, 41,400 cfs was conveyed by the levees in February 1958. The design water surface profile was based on hydraulic backwater computations assuming conditions during the final stage of the 50-year project life. In the northern two-thirds of the basin, the west basin levee would also serve as the right bank training levee and would have a freeboard requirement of 5 feet above the 30,000 cfs flood profile for Cache Creek flows through the training channel. Thus, the 5-foot freeboard requirement above the 30,000 cfs flood profile for flow through the settling basin without an interior training channel levee would be exceeded. The interior training channel levee would have crown elevations 2 feet less than the corresponding opposite west basin levee. Existing training channel levees would be degraded, and the training channel would be relocated adjacent to the west basin levee.

29. To retain a minimum of 3 feet of freeboard in Cache Creek above the flood profile of 30,000 cfs (flow used for the design of the existing project levees on Cache Creek), the existing Cache Creek levees would be raised from where they joined the settling basin north and west levees to Road 102 about 3,400 feet upstream. The right bank levee would be raised an average of 2 feet, while the left bank levee would only require shaping. All project levees would be provided with a 12-foot crown width and side slopes of 1 on 3 on the waterside and 1

on 2 on the landside. The west basin levee, which is a low levee originally constructed without an inspection trench by local interests, would be provided with a standard levee inspection trench. All project levees would have a stabilized aggregate surfaced patrol road on the levee crown. The location of the proposed project levees, together with typical sections, is shown on plate E-3. Levee profiles along with design flood planes are shown on plate E-5.

30. A new channel between the new training levees would be excavated to a size and depth comparable to the existing channel of Cache Creek to negate backwater effects in Cache Creek above Road 102 due to insufficient channel capacity. The training channel would then be maintained throughout the life of the project to retain the initial channel capacity. In addition, a low flow pilot channel would be maintained from the training channel, across the basin, and to the weir. Outlets through the weir would pass low flows into the Yolo Bypass without widespread overtopping of the weir crest.

Relocations and Modifications

31. The sediment control project would modify the city of Woodland's storm runoff pumping facility by increasing its pumping capability. A portion of the floodwater from the city flows easterly to the southwest corner of the Cache Creek Settling Basin, where a pumping plant, owned and operated by the city of Woodland, pumps and discharges the water into the settling basin. Because the project flood plane elevation in

the settling basin would be increased during the final stage of project life, the pumping head would have to be increased by about 12 feet, or about 2-1/2 times the existing pumping head. Relocation and modification of existing irrigation, drainage, and sewerlines will be accomplished as appropriate during construction of the project.

32. Relocations would consist of removing three dwellings located in the north portion of the settling basin. Residents of those dwellings would be provided relocation assistance.

Rights-of-Way

33. The State of California holds rights-of-way for settling basin lands based on a line 5 feet from the existing landside levee toe to a line 5 feet from the existing waterside levee toe. The project plan would require rights-of-way in fee for the entire settling basin, approximately 3,600 acres. The Federal Government would fee purchase the entire 3,600 acres and would be reimbursed by non-Federal interests for that portion attributed to sediment control. This amount, totaling $1.8 million, is the cost which would have been required to acquire flowage, sediment deposition, and removal easements over the 50-year project life should these lands not have been purchased in fee. Levee enlargement for Cache Creek from the settling basin to Road 102 would be on the waterside of the existing levee, and no additional rights-of-way would be required beyond those presently held by the State of California.

Construction

34. Following completion and approval of advance engineering and design studies, and assuming adequate funding availability, it is estimated that the Lower Basin portion of the project could be constructed in 2 years. About 3 million cubic yards of embankment material, which would be taken from within the existing basin, would be required for construction of all levees, including those for refuge management. Levee heights were designed correspondingly to allow for this quantity of material taken from within the existing basin.

35. All facilities, except those needed for refuge operation, would be constructed during one construction season. Future facilities within the refuge may be constructed by the U.S. Fish and Wildlife Service as plans are developed. After construction, all scarred areas (new levees and borrow areas) would be planted with native vegetation.

Operation and Maintenance

36. Operation and maintenance of sediment control facilities would be a non-Federal responsibility and would be accomplished in accordance with Federal regulations. Normal operation and maintenance costs would be expected for the enlarged weir and levees. As occurs under existing conditions, the eastern training levee would be modified as appropriate during the life of the project to direct flow (and thus sediment

the settling basin would be increased during the final stage of project life, the pumping head would have to be increased by about 12 feet, or about 2-1/2 times the existing pumping head. Relocation and modification of existing irrigation, drainage, and sewerlines will be accomplished as appropriate during construction of the project.

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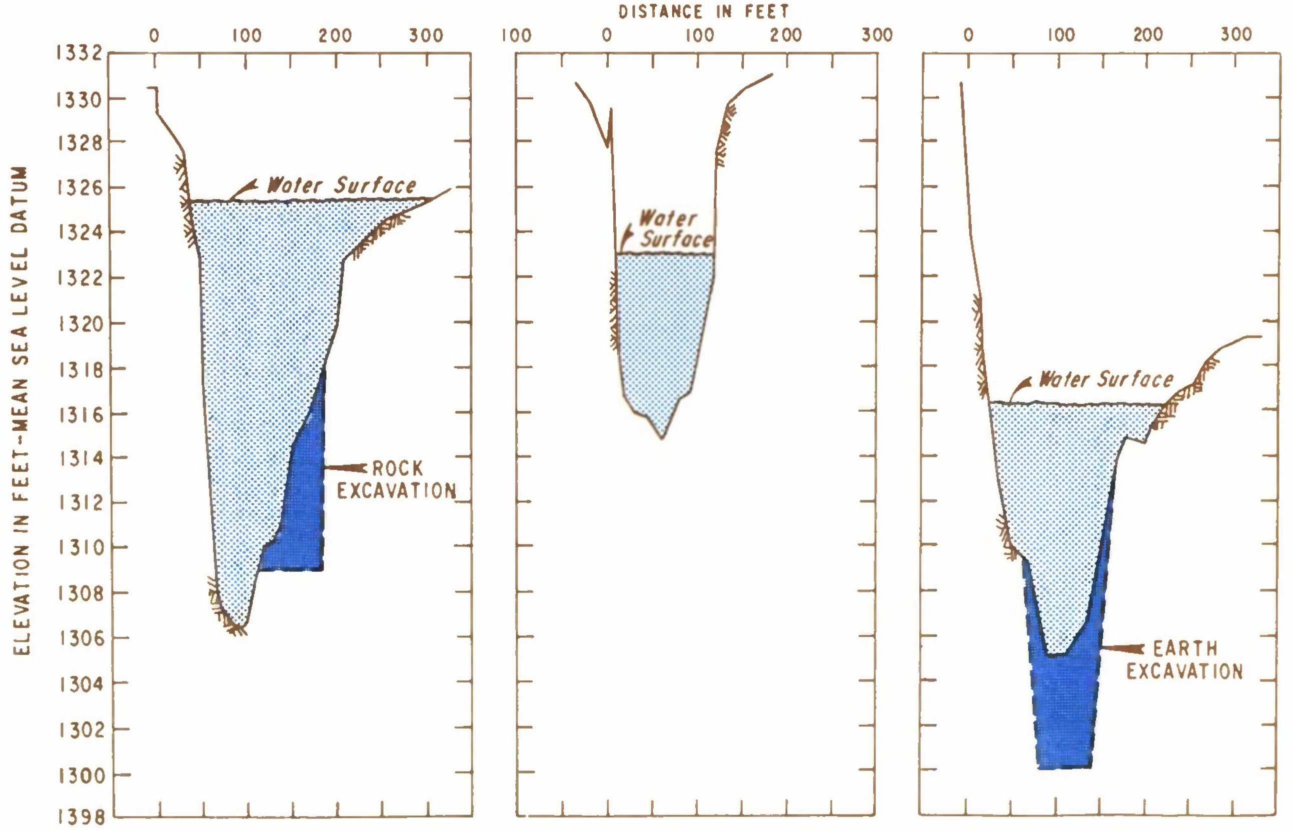
Operation and Maintenance

36. Operation and maintenance of sediment control facilities would be a non-Federal responsibility and would be accomplished in accordance with Federal regulations. Normal operation and maintenance costs would be expected for the enlarged weir and levees. As occurs under existing conditions, the eastern training levee would be modified as appropriate during the life of the project to direct flow (and thus sediment

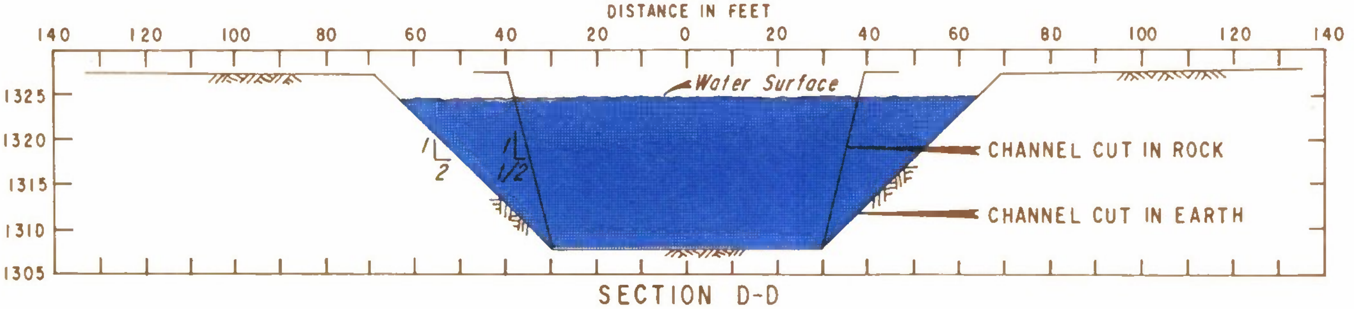
deposition) across the sedimentation basin. Operation and maintenance of the wildlife refuge and its facilities would be the responsibility of the wildlife agency. Since most of the water needed for the wildlife refuge operation would come from wells, a significant operation expense will be incurred for pumping. The city of Woodland would be responsible for increased pumping costs of its storm runoff pumping facility.

37. Close coordination of operational procedures would be required between the U.S. Fish and Wildlife Service and the California Reclamation Board, potential project sponsor, to insure compatibility between sediment control and wildlife enhancement. To prolong the life of the project, the Reclamation Board would reserve the right to remove deposited sediment in the future, if a demand evolved for such sediment. Excavated sediment would become the property of the State. Average annual operation and maintenance costs would total $19,100 for sediment control operations and $125,000 for the wildlife refuge.



SECTION A-A SECTION B-B SECTION C-C

EXISTING CHANNEL TYPICAL CROSS SECTIONS



SECTION D-D

BYPASS CHANNEL SECTION

COURT DECREES AFFECTING CLEAR LAKE OPERATION

1. Gopcevic Decree (1920)
   a. Maximum Clear Lake stage cannot exceed 9.00' on Rumsey Gage, at Lakeport at any time. Stages between 7.56' and 9.00' are permitted for up to 10 successive days for temporary floodwater storage.
   b. Minimum Clear Lake stage set at zero on Rumsey Gage. In determining releases from the lake, irrigation, evaporation, and other losses must be included.
   c. Prohibits any alteration of the outlet channel except that necessary to carry out the provisions of the decree.
2. Bemmerly Decree (1940)
   a. Prohibits any widening, deepening, or enlarging of the Clear Lake Outlet Channel that could increase the flow from Clear Lake into Cache Creek.

PROPOSED CLEAR LAKE FLOOD OPERATION CRITERIA

The outlet channel will be operated so as to reduce stages at Clear Lake as much as possible without causing flows at Rumsey in the range above 20,000 c.f.s. to exceed the flows which would occur under present conditions. This will be accomplished by releasing at the project channel capacity as long as flows at Rumsey are not projected to exceed 20,000 c.f.s. and by controlling releases from Clear Lake to the present outlet capacity for the corresponding stage when flows at Rumsey are projected to exceed 20,000 c.f.s.

LEGEND

Existing channel

Proposed enlarged channel and bypass

N

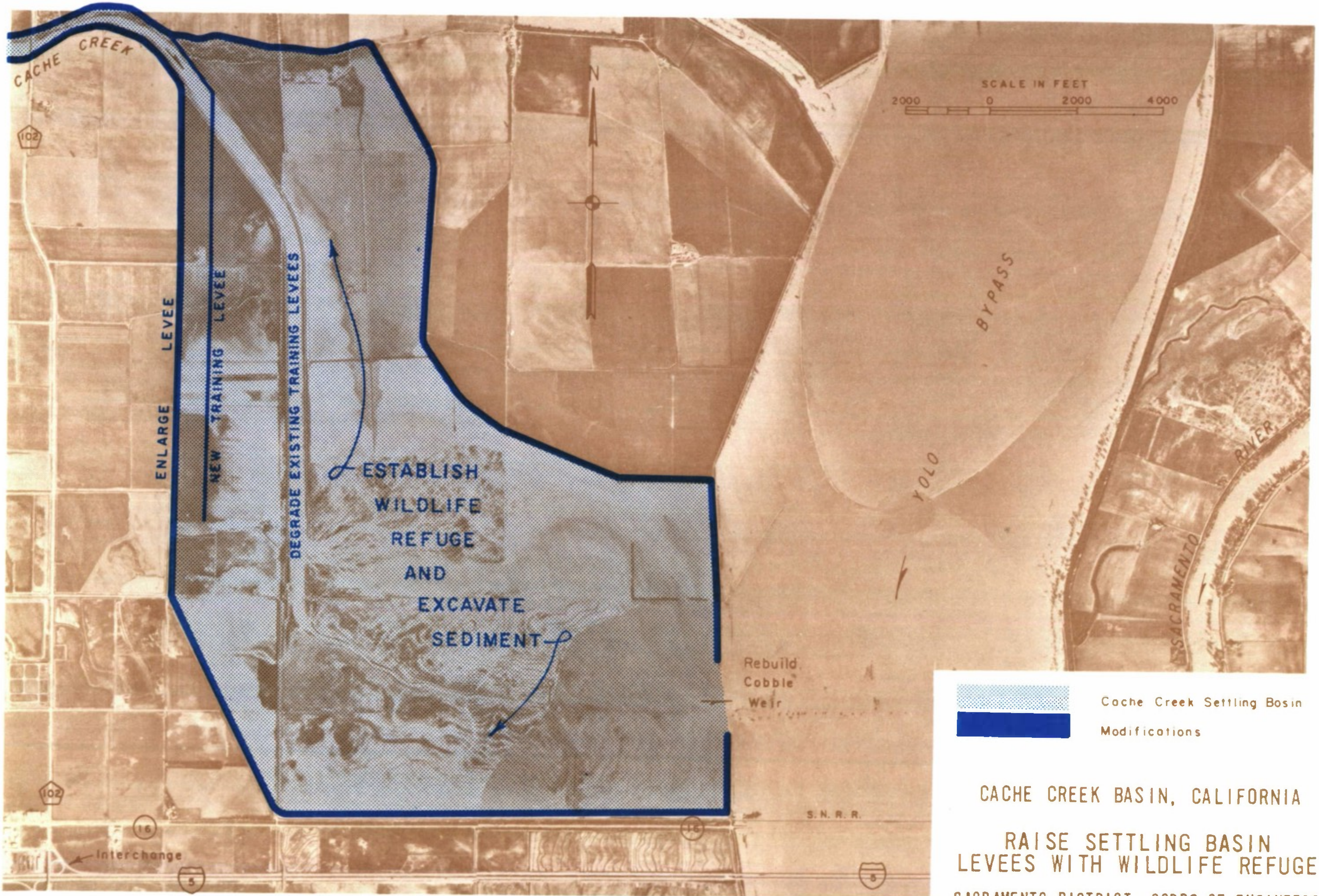
SCALE IN FEET
1000 0 1000 2000

CACHE CREEK BASIN, CALIFORNIA

ENLARGE CLEAR LAKE
OUTLET CHANNEL AND BYPASS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

APPENDIX I PLATE E-1

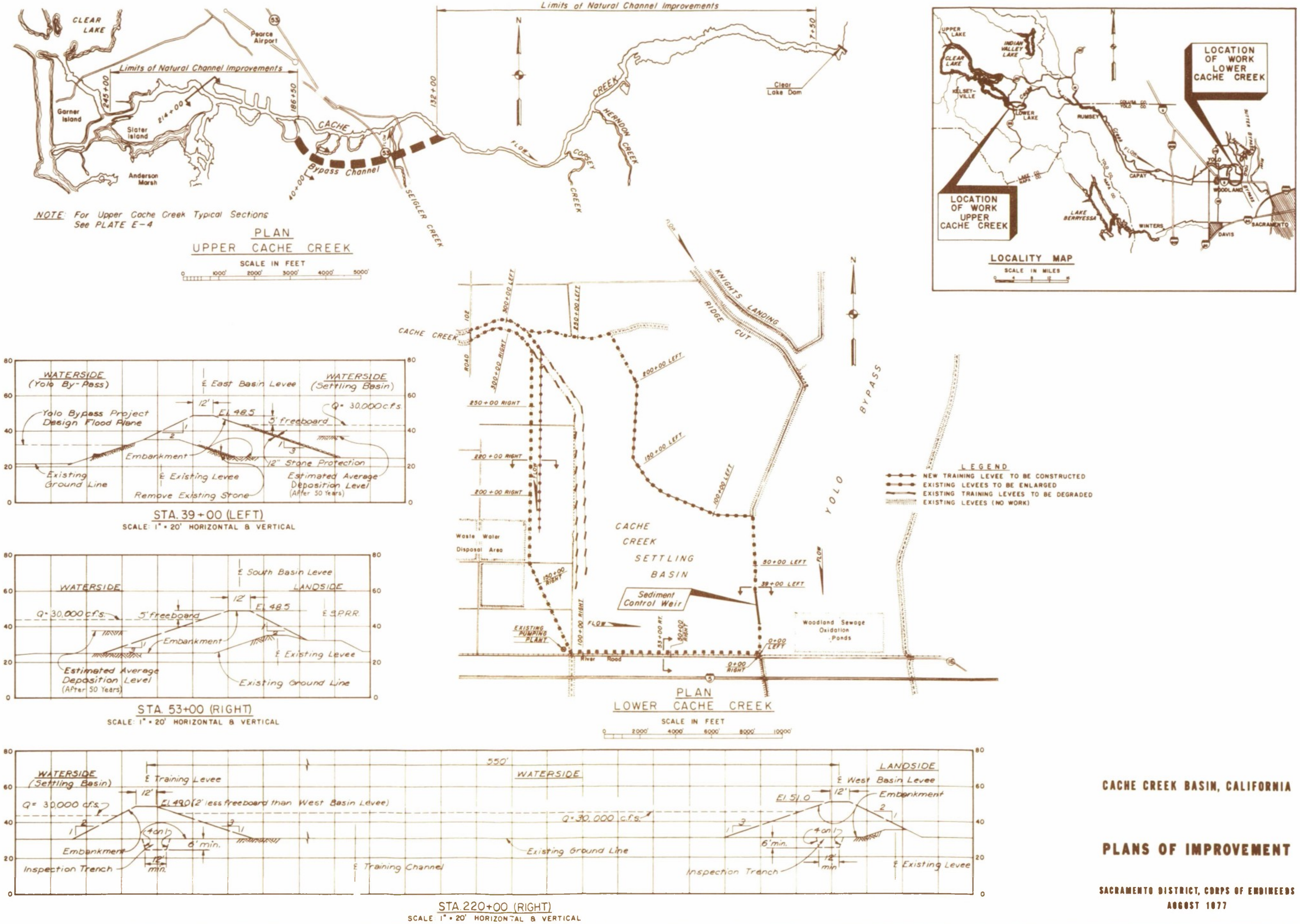


CACHE CREEK BASIN, CALIFORNIA

RAISE SETTLING BASIN
LEVEES WITH WILDLIFE REFUGE

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

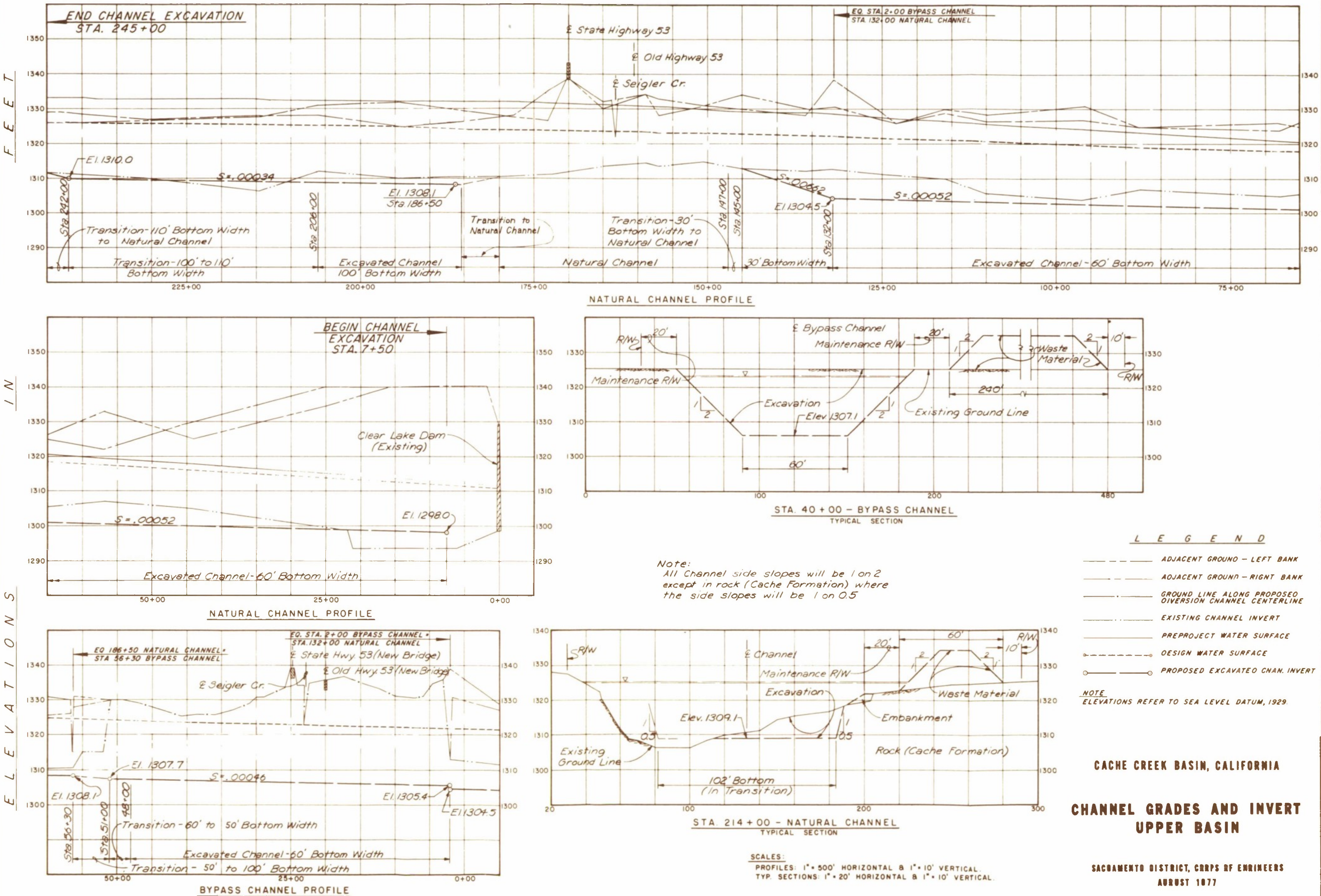
APPENDIX I PLATE E-2



CACHE CREEK BASIN, CALIFORNIA

PLANS OF IMPROVEMENT

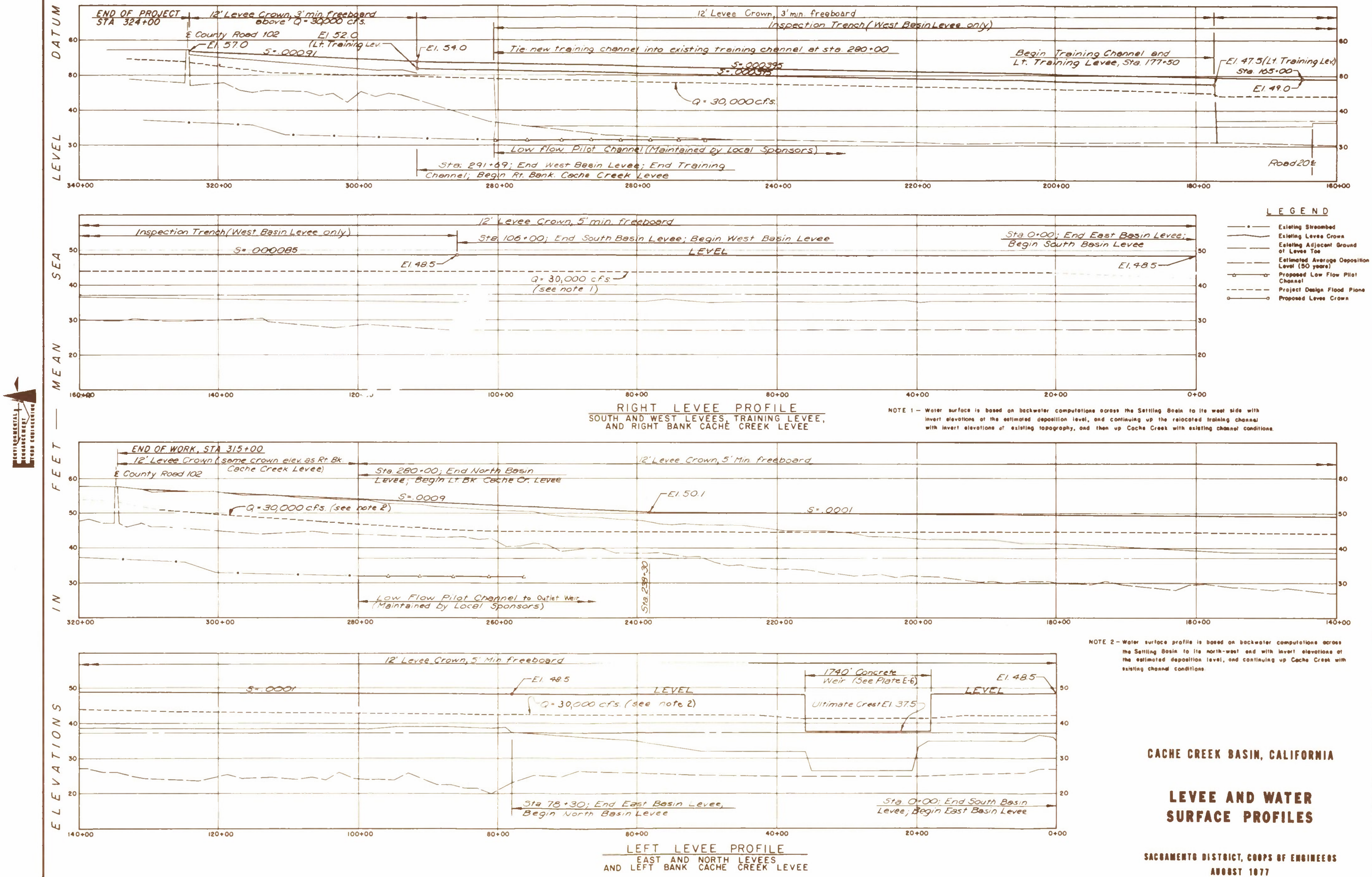
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



CACHE CREEK BASIN, CALIFORNIA

CHANNEL GRADES AND INVERT UPPER BASIN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



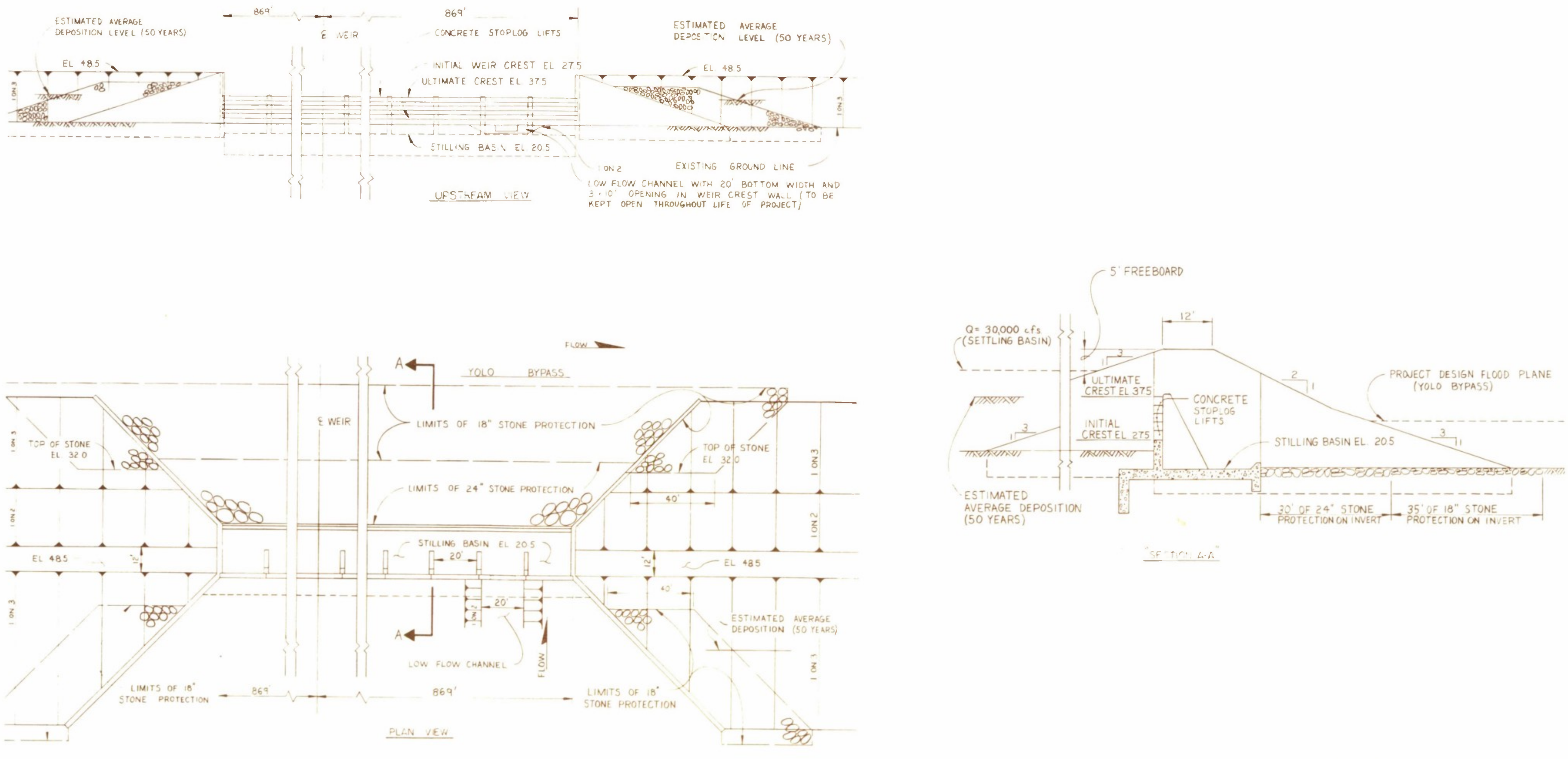
NOTE 1 – Water surface is based on backwater computations across the Settling Basin to its west side with invert elevations of the estimated deposition level, and continuing up the relocated training channel with invert elevations of existing topography, and then up Cache Creek with existing channel conditions.

NOTE 2 – Water surface profile is based on backwater computations across the Settling Basin to its north-west and with invert elevations at the estimated deposition level, and continuing up Cache Creek with existing channel conditions.

CACHE CREEK BASIN, CALIFORNIA

LEVEE AND WATER SURFACE PROFILES

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

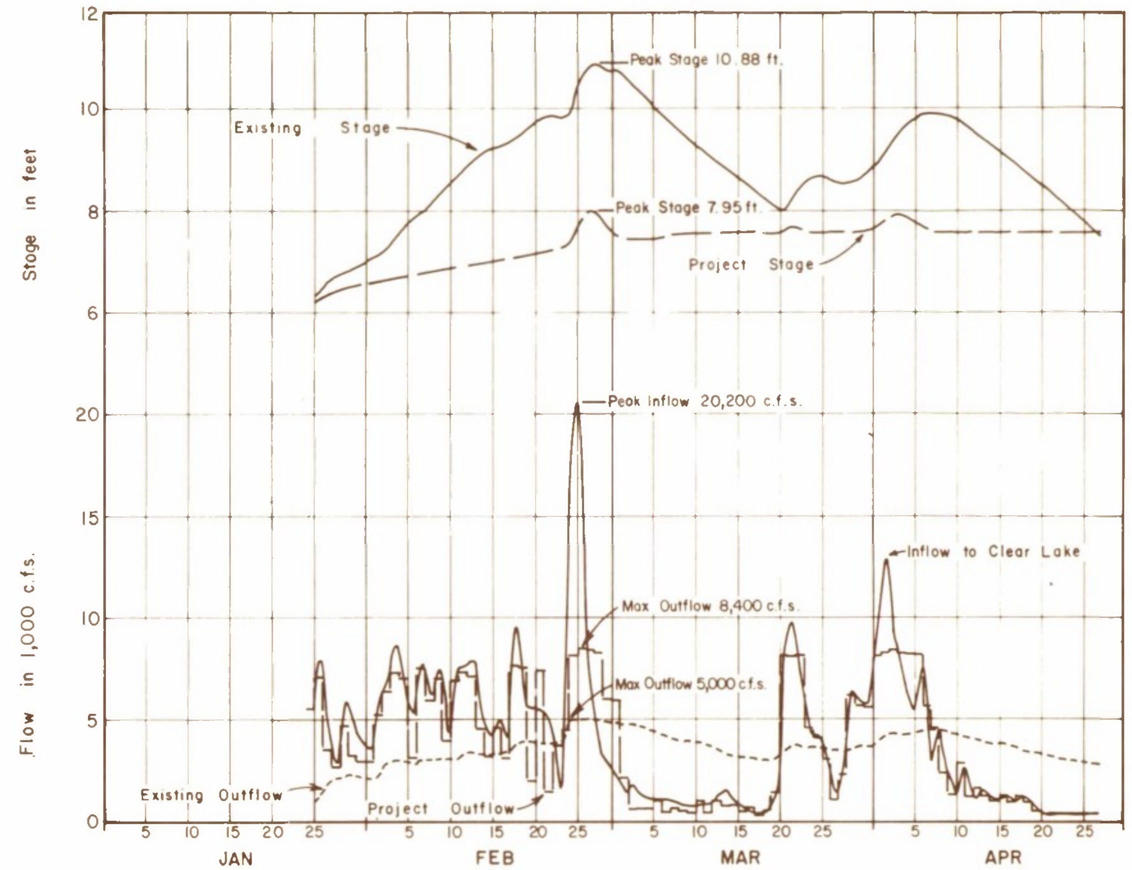


CACHE CREEK SETTLING BASIN WEIR
NOT TO SCALE

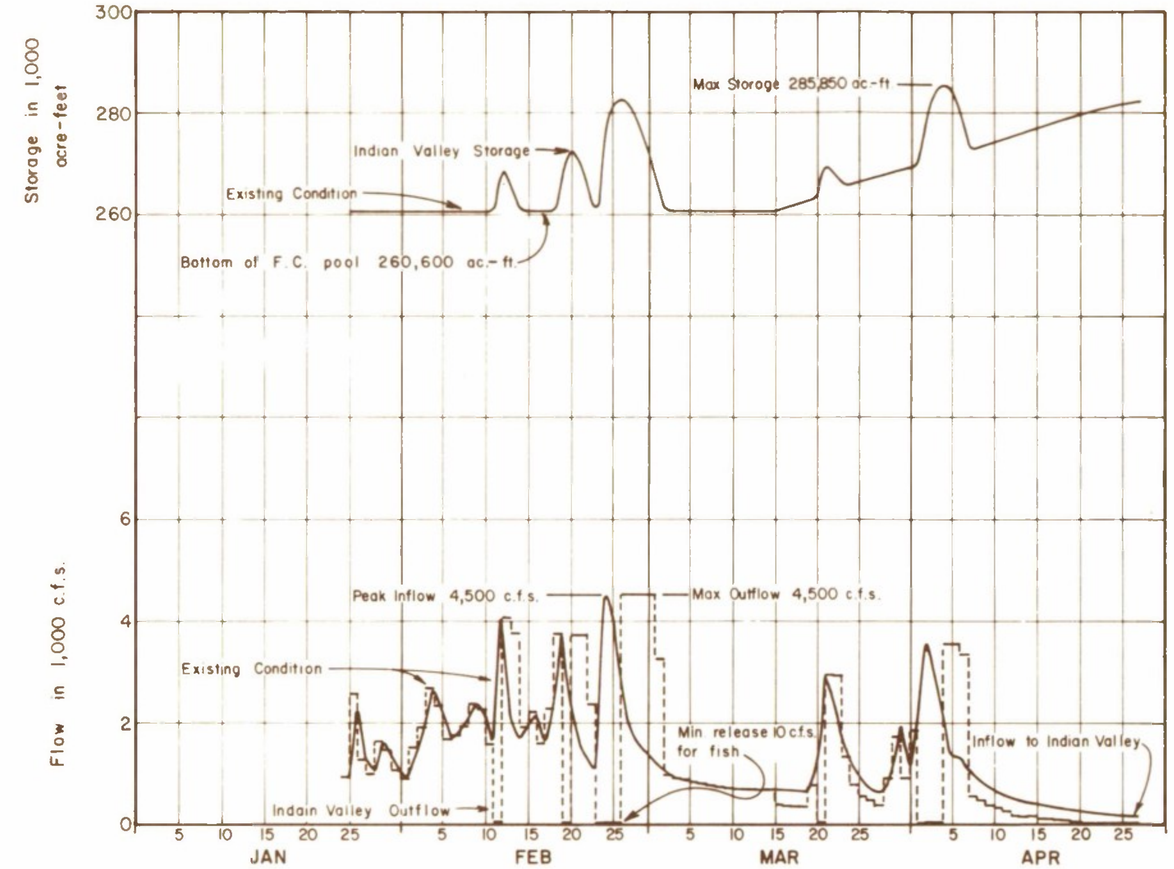
CACHE CREEK BASIN, CALIFORNIA

SETTLING BASIN WEIR

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



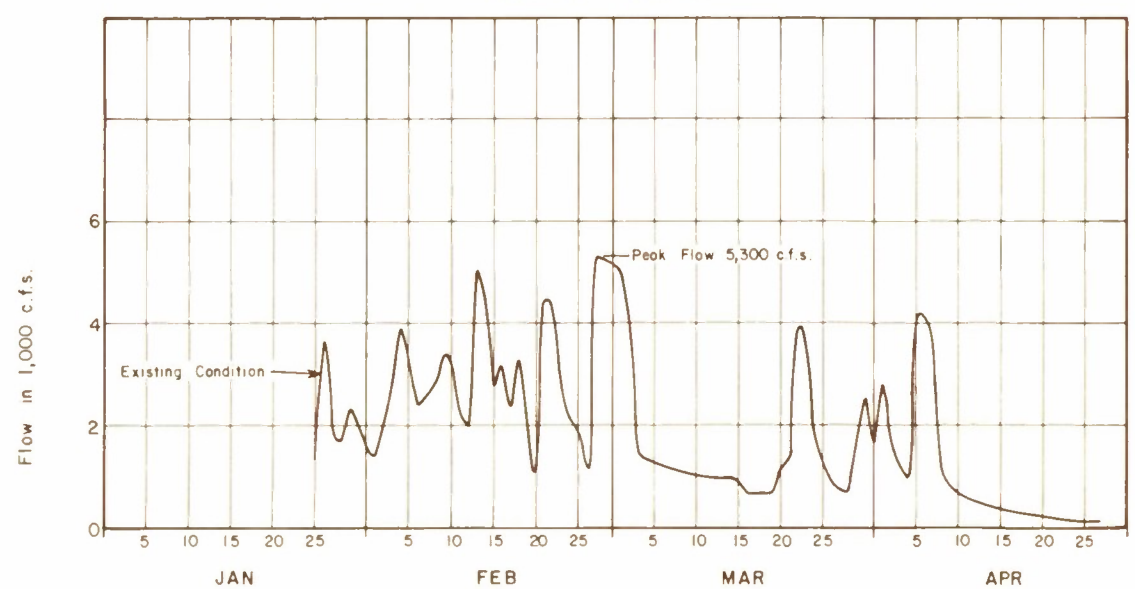
CLEAR LAKE



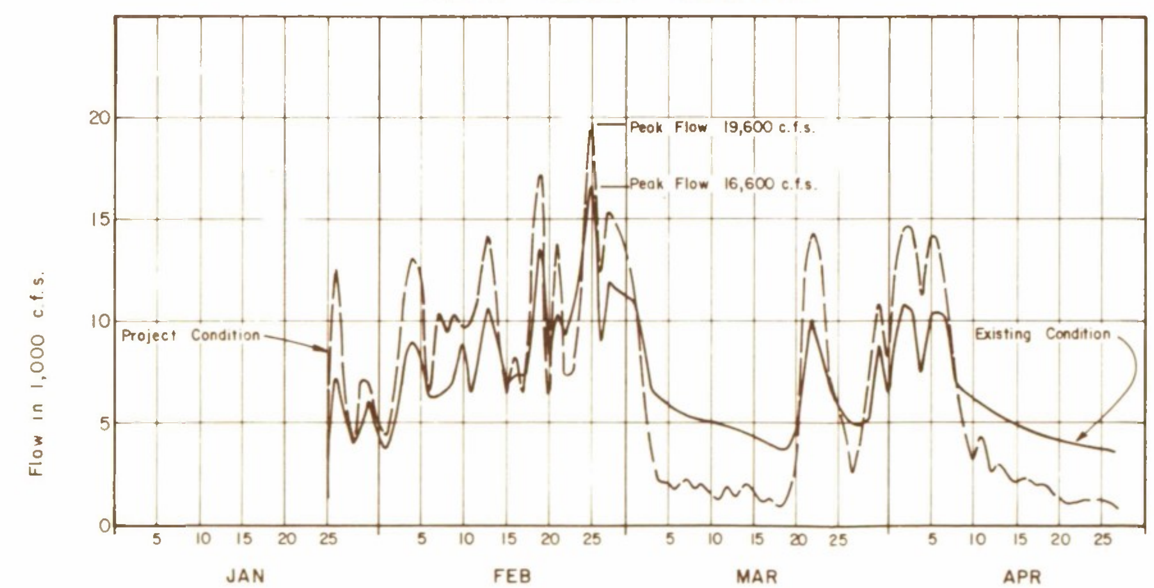
INDIAN VALLEY RESERVOIR

NOTE:

Hydrographs for Indion Valley and North Fork Cache Creek near Lower Lake are identicol for both project and existing conditions.



NORTH FORK CACHE CREEK near LOWER LAKE

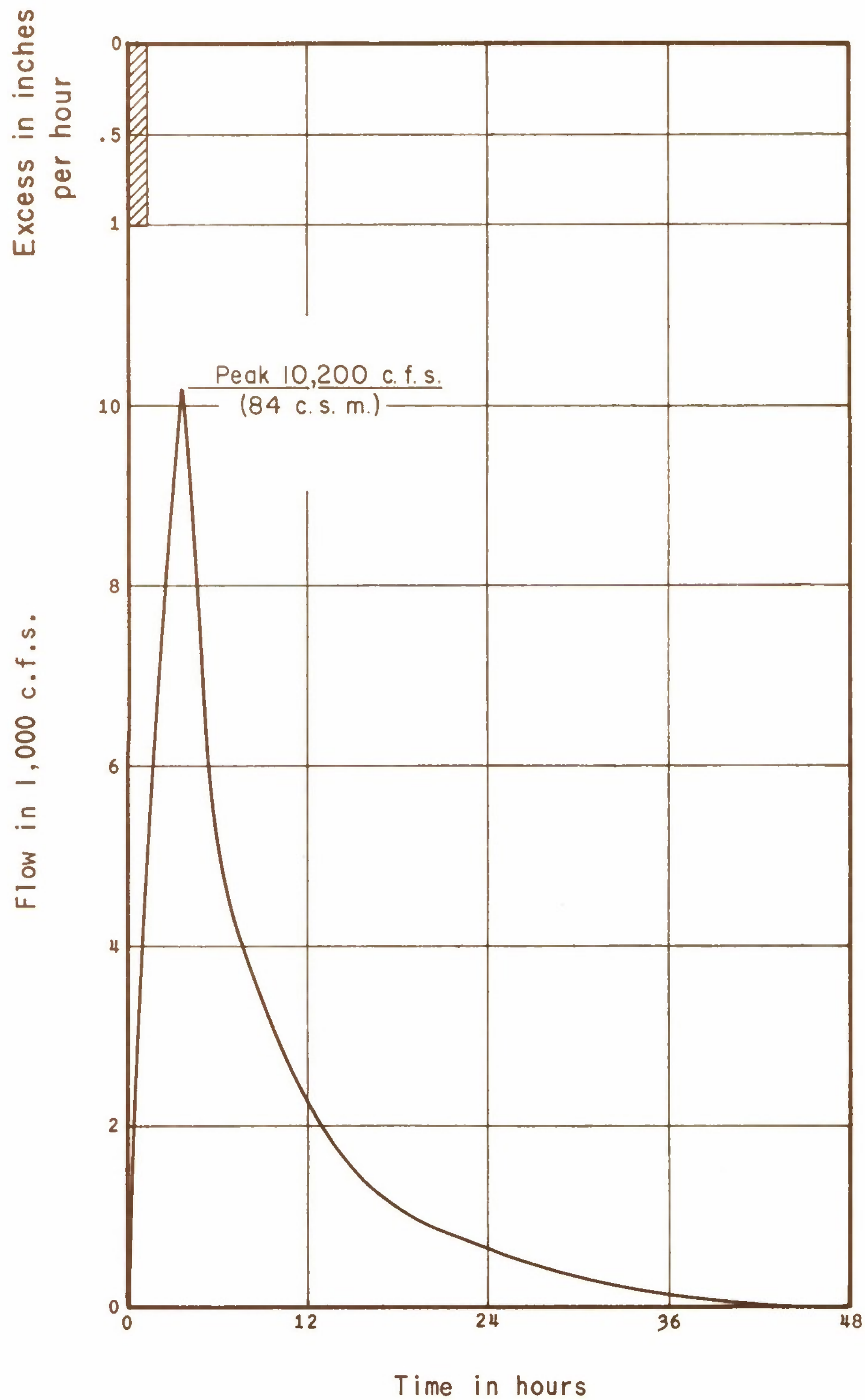


CACHE CREEK near CAPAY

CACHE CREEK BASIN, CALIFORNIA

1958 FLOOD HYDROGRAPH

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1979

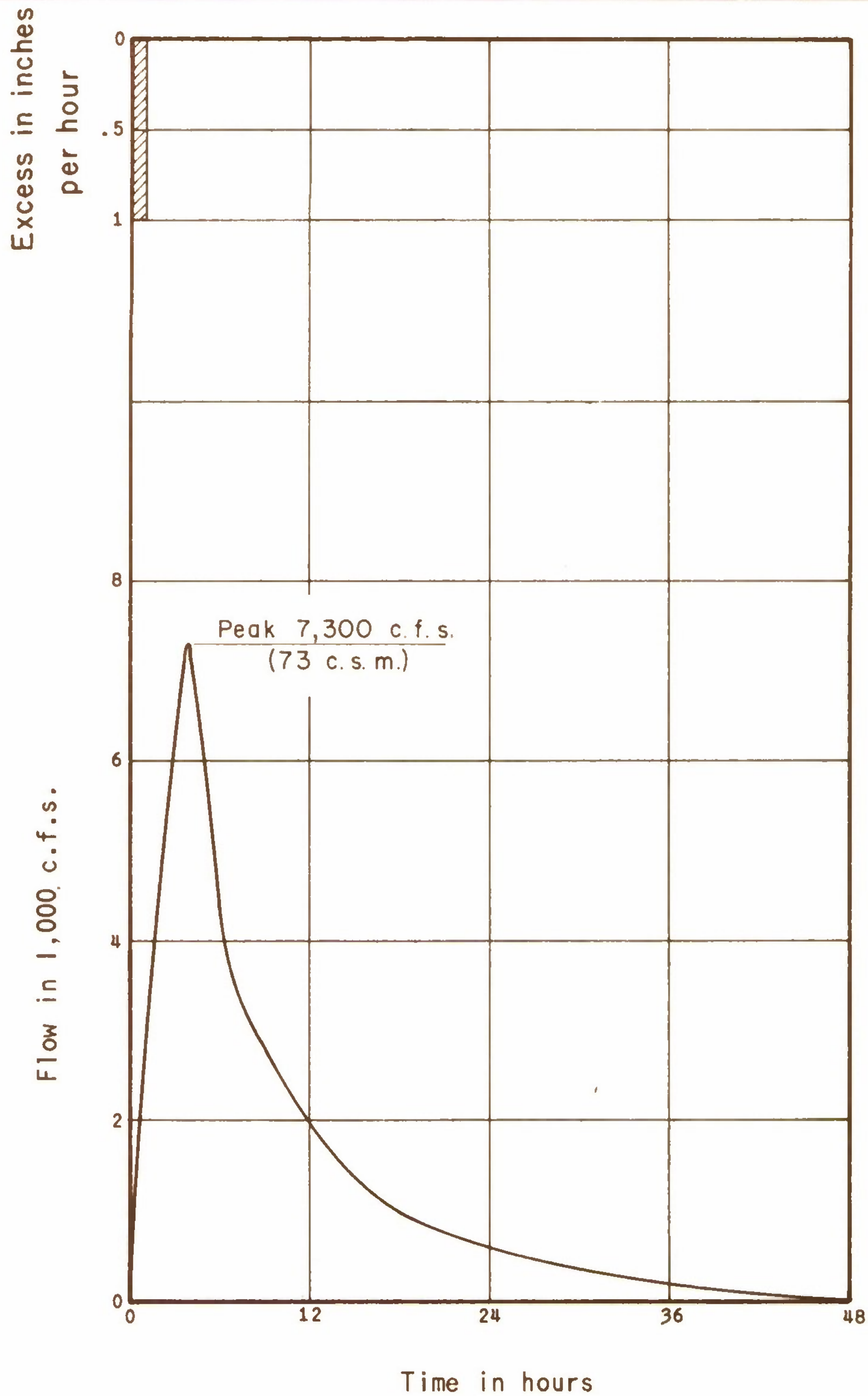


CACHE CREEK BASIN, CALIFORNIA

UNIT HYDROGRAPH-SPF
NORTH FORK CACHE CREEK AT
INDIAN VALLEY RESERVOIR
INDEX POINT-4

DRAINAGE AREA : 121 sq. mi.

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



CACHE CREEK BASIN, CALIFORNIA

UNIT HYDROGRAPH-SPF

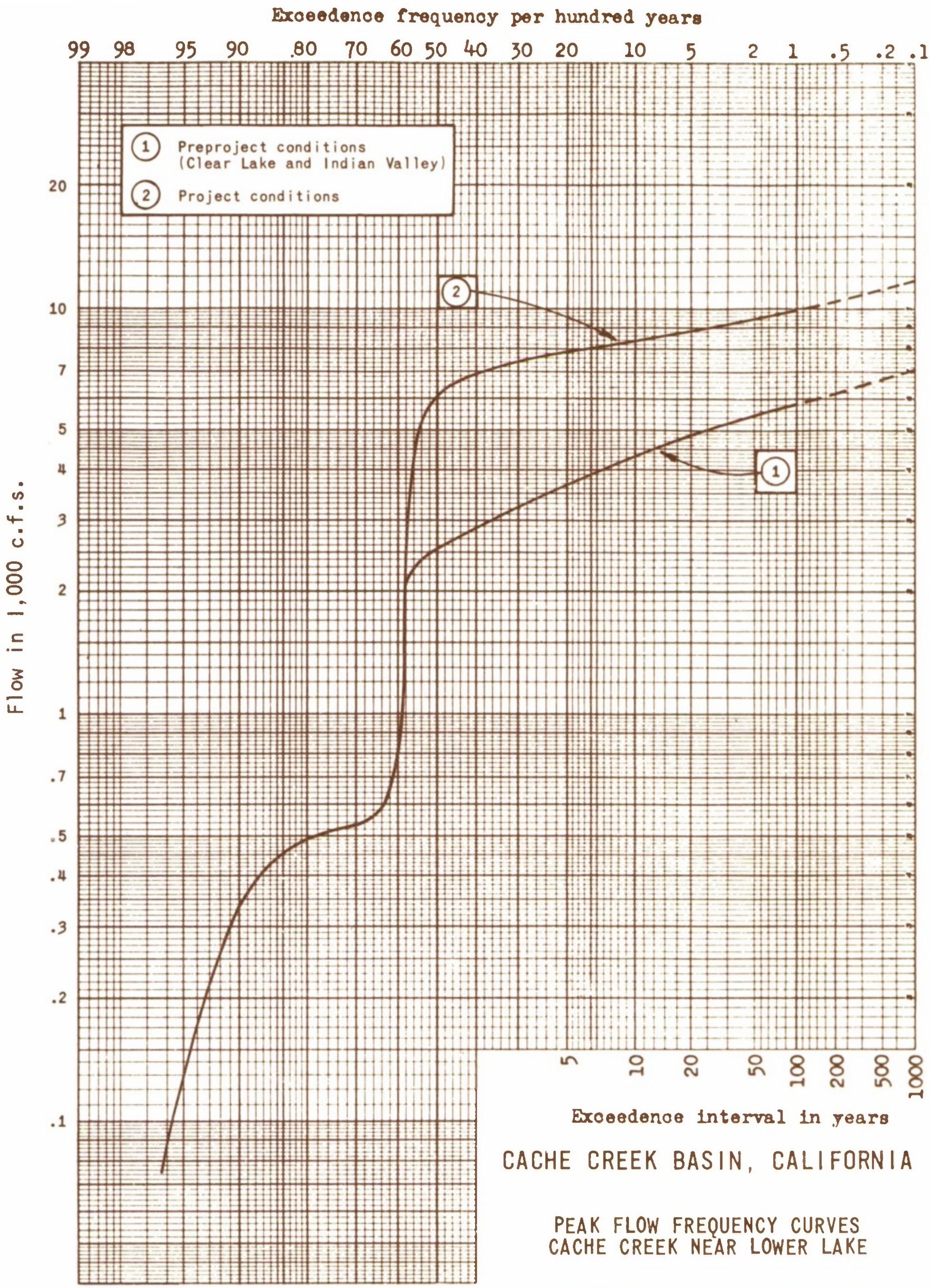
BEAR CREEK NEAR RUMSEY

INDEX POINT-6

DRAINAGE AREA: 100 sq. mi.

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

AUGUST 1977



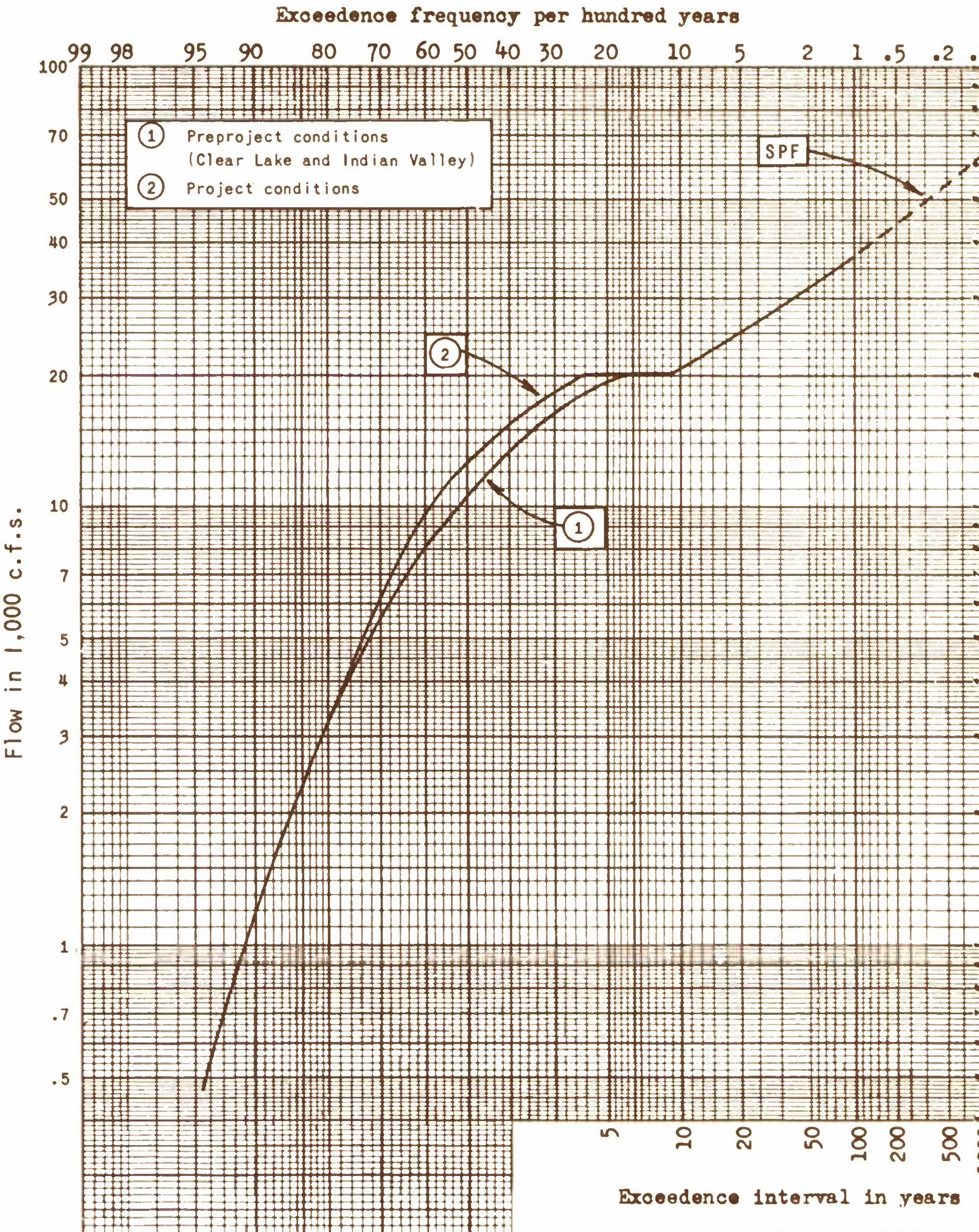
CACHE CREEK BASIN, CALIFORNIA

PEAK FLOW FREQUENCY CURVES
CACHE CREEK NEAR LOWER LAKE

Drainage area:
528 sq. mi.

Period of record:
1945-1977

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
JULY 1979



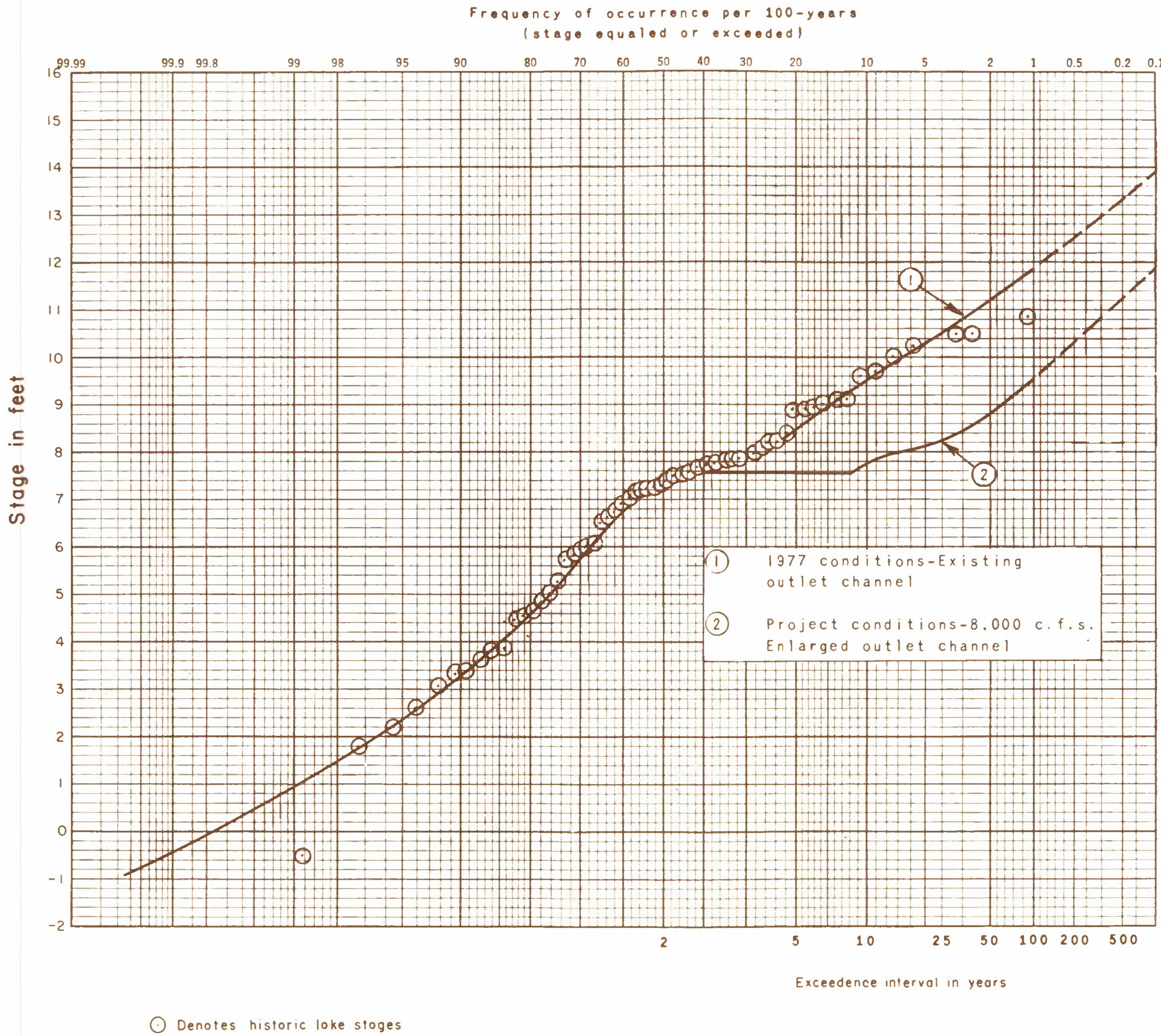
CACHE CREEK BASIN, CALIFORNIA

PEAK FLOW FREQUENCY CURVES
CACHE CREEK ABOVE RUMSEY

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
JULY 1979

Drainage area:
955 sq. mi.

Period of record:
1942-1977



CLEAR LAKE WAS OPERATED AS FOLLOWS:

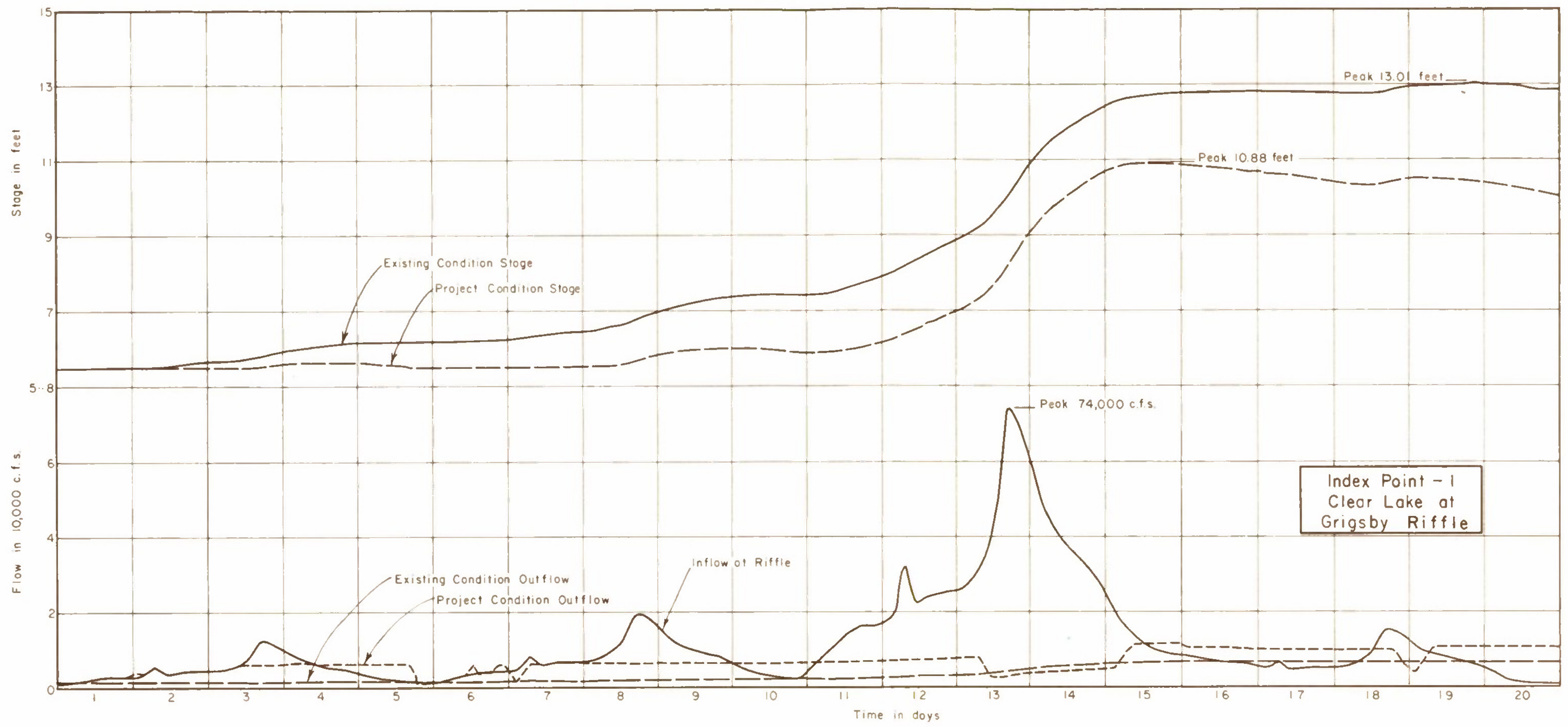
a. Release project channel capacity when the flow at Rumsey is forecasted to be less than 20,000 cfs.

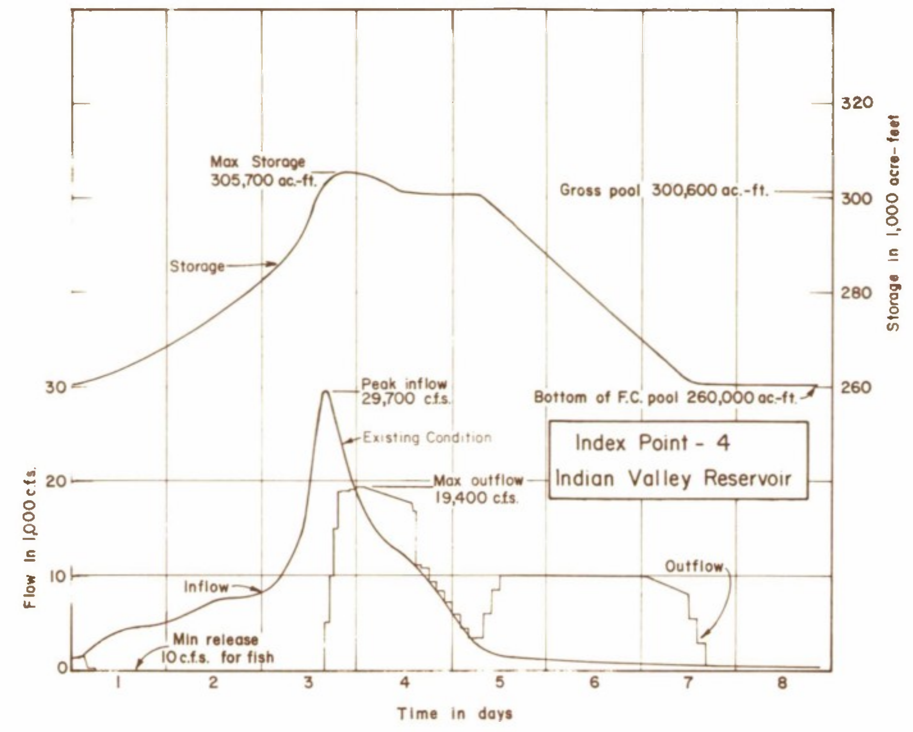
b. Release pre-project channel capacity when the flow at Rumsey is forecasted to be greater than 20,000 cfs.

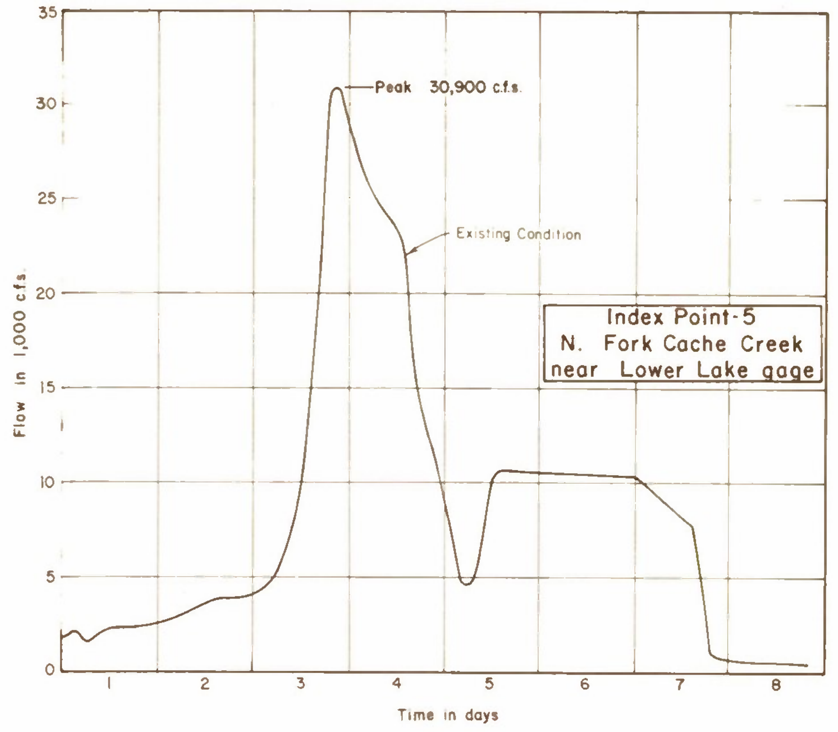
CACHE CREEK BASIN, CALIFORNIA

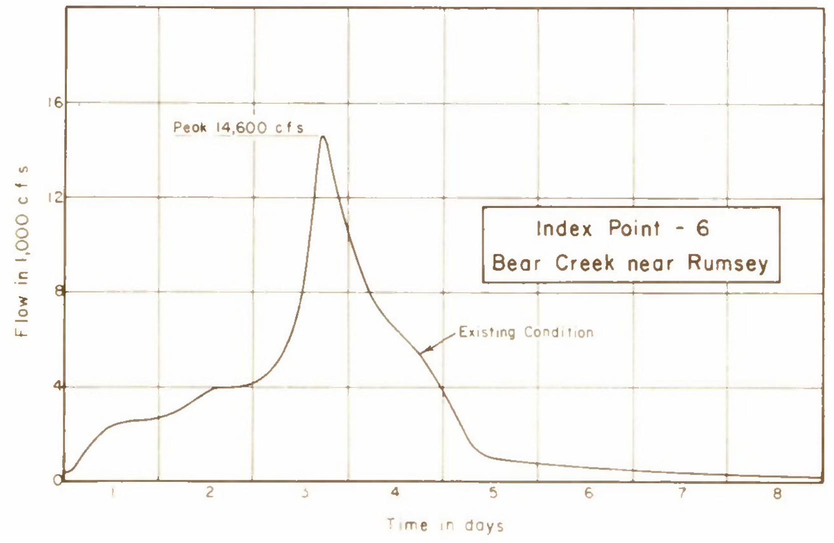
CLEAR LAKE STAGE FREQUENCY

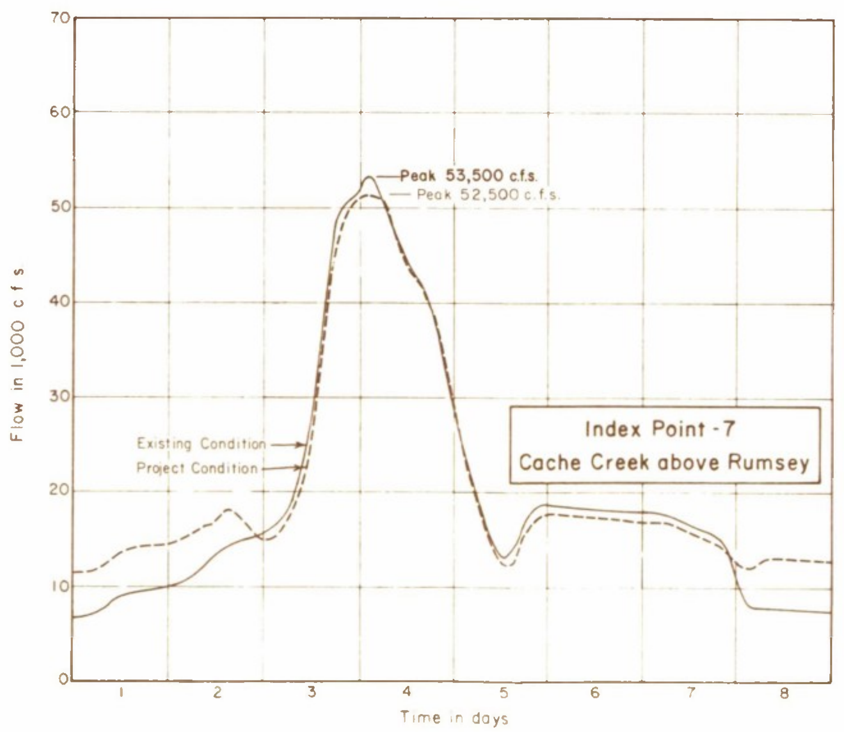
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

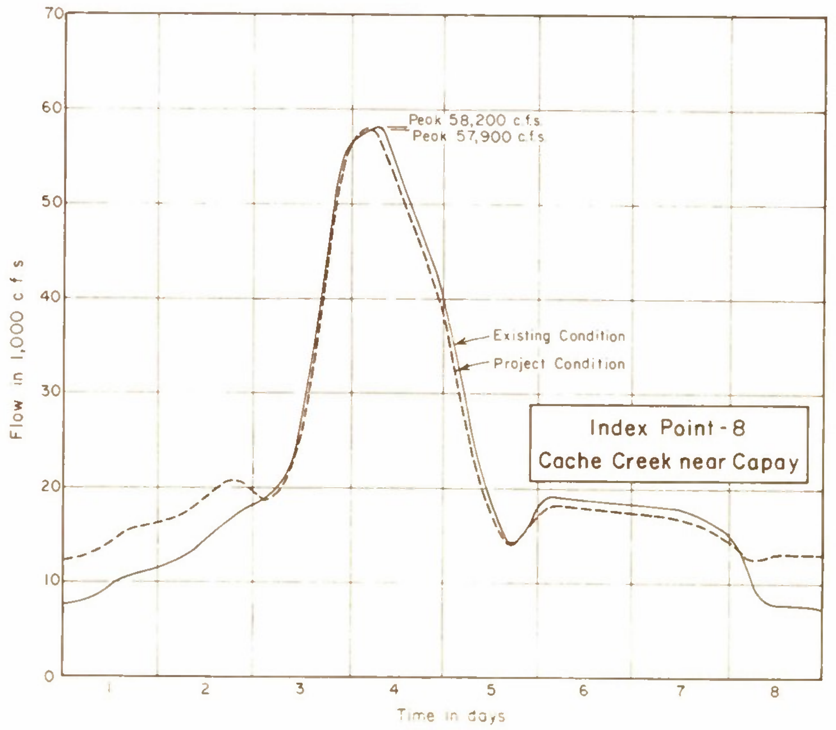












NOTES:

1. Hydrographs at index points 4, 5 and 6 are identical for both project and existing conditions.

2. Hydrographs for Clear Lake are for an SPF centered over Clear Lake and are the critical conditions for Clear Lake stages. Hydrographs for all other points are for an SPF centered over Indian Valley and are the critical conditions for those points.

CACHE CREEK BASIN, CALIFORNIA

STANDARD PROJECT FLOOD HYDROGRAPHS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

NOTES:

Project Standard Project Flood plain elevation is 10.88 feet on the Rumsey Gage at Lakeport (1,329.53 feet Mean Sea Level Oatum).

Project 100-Year flood plain elevation is 9.6 feet on the Rumsey Gage at Lakeport (1,328.25 feet Mean Sea Level Oatum).

LEGEND

100-Year Flood Plain

Standard Project Flood Plain

CACHE CREEK BASIN, CALIFORNIA

PROJECT 100-YEAR AND STANDARD PROJECT FLOOD PLAINS CLEAR LAKE

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

SECTION F

ECONOMICS OF THE SELECTED PLANS

ECONOMICS OF THE SELECTED PLANS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

TABLE OF CONTENTS (Cont'd)

LIST OF PLATES

SECTION F

ECONOMICS OF THE SELECTED PLANS

1. This section includes centralized economic material including cost and benefit data for those facets of the project which can readily be quantified in dollar values.

Methodology

2. Economic justification of the proposed works was established by comparing the equivalent average annual charges with the estimated equivalent average annual benefits which would be realized over the 100-year and 50-year periods of analysis for flood control (Upper Basin) and sediment control (Lower Basin), respectively. Annual flood control benefits are based on the difference in flood damages for projected conditions without and with the project. National Economic Development (NED) employment benefits are those payments to unemployed or underemployed local labor resources directly employed in the

construction and installation of the project. Annual sediment control benefits are based on (1) the difference in downstream dredging requirements without and with the project plus (2) costs that would be incurred should no sediment control plan be implemented. The primary cost for (2) above, discussed in detail later in this section, would be for raising portions of the levees of the Yolo Bypass, Knights Landing Ridge Cut, and Sacramento River in order to preserve the integrity of the Sacramento River Flood Control Project. Wildlife enhancement benefits, developed by the U.S. Fish and Wildlife Service in conjunction with the California Department of Fish and Game, are based on both direct and indirect uses associated with establishing the wildlife refuge. The benefit-cost ratio, which is a comparison of annual costs and benefits, was developed as a means to demonstrate the project feasibility by showing the relative average annual benefits to the annual costs.

3. The value of benefits and costs at their time of accrual is made comparable by conversion to an equivalent time basis using an appropriate interest rate. An interest rate of 6-5/8 percent was used in this report. The net effect of converting benefits and costs in this manner is to develop equivalent average annual values.

4. An additional consideration is maximization of net monetary benefits. Use of this concept develops the optimum combination of

project functions, the sizing of facilities, and development of the area to obtain the greatest excess of monetary benefits over costs.

Costs

Basis of Estimate of First Cost

5. The detailed estimate of first cost is based on 1 October 1977 price levels. The estimated cost of lands was furnished by the State of California Department of Water Resources and reviewed by the Sacramento District Real Estate Division. The unit prices for Federal costs used for excavation and embankment items were derived by the District's Estimating Section from a breakdown of plant, labor, and material; and the other items were based on adjustments of average bid prices received for comparable work in the same general area. The non-Federal costs were furnished by the State Reclamation Board. Due to limited availability of detailed soils investigations and explorations, the exact amount of rock excavation is unknown and, therefore, a 25 percent contingency allowance was included in the estimates. A suitable allowance has been included for engineering and design and supervision and administration based on costs experienced on similar work in the Sacramento District.

Basis of Estimate of Annual Cost

6. The detailed estimate of annual cost is based on 1 October 1977 price levels, a 6-5/8 percent interest rate, and a 100-year authorization period for the Upper Basin (Clear Lake) and a 50-year amortization period for the Lower Basin (Cache Creek). The annual costs were determined in accordance with EM 1120-2-104. The maintenance, operation, and major replacement costs were based on costs experienced on similar work in the Sacramento District. No interest during construction was included in the estimate due to the short construction period (less than 2 years).

Table F-1

UPPER BASIN (CLEAR LAKE)
COST INFORMATION ($1,000)

	Construction	Land, Damages, and Relocations	Total
First Cost			
Federal	3,740	0	3,740
Non-Federal	0	2,310	2,310
Total	3,740	2,310	6,050
Annual Cost			
Federal			
Interest	247.8	0	247.8
Amortization	0.5	0	0.5
Total	248.3	0	248.3
Non-Federal			
Interest	0	153.0	153.0
Amortization	0	0.3	0.3
Operation & Maintenance	1.0	0	1.0
Replacement	10.4	0	10.4
Total	11.4	153.3	164.7
Total Annual Cost	259.7	153.3	413.0

Table F-2

LOWER BASIN (CACHE CREEK)
COST INFORMATION ($1,000)

	Flood and Sediment Control		Wildlife Enhancement		
	Construction	Lands and Relocations	Construction	Lands and Relocations	Total
First Cost					
Federal	8,220	0	560	850	9,630
Non-Federal	0	2,280*	0	0	2,280
Total	8,220	2,280	560	850	11,910
Annual Cost					
Federal					
Interest	544.4		37.1	56.3	637.8
Amortization	23.0		1.6	2.4	27.0
Operation & Maintenance	0		125.0	0	125.0
Total	567.4		163.7	58.7	789.8
Non-Federal					
Interest		151.0			151.0
Amortization		6.5			6.5
Operation & Maintenance	19.1				19.1
Total	19.1	157.5			176.6
Total Annual Cost	586.5	157.5	163.7	58.7	966.4

*Includes reimbursement by non-Federal interests for that portion of lands attributed to sediment control. This amount, totaling $1,800,000, would equal that cost required to acquire flowage, sediment deposition, and removal easements on settling basin lands over the 50-year project life should the basin lands not have been purchased in fee.

Shown in tables F-3 and F-4 are detailed cost estimates of the Upper Basin (Clear Lake) and Lower Basin (Cache Creek) plans, respectively.

Table F-3

DETAILED COST ESTIMATE
UPPER BASIN (CLEAR LAKE)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
	FEDERAL COST				
09	CHANNELS				
	Excavation				
	rock (blasting reqd.)	82,000	cy	4.75	389,500
	rock (ripping reqd.)	163,000	cy	3.00	489,000
	common excavation	660,000	cy	2.10	1,386,000
	Clearing	120	acre	150.00	18,000
	Seigler Creek Siphon	1	job	L.S.	14,000
	Seeding	75	acre	400.00	30,000
	Water (dust control)	4,500	Mgal	2.00	9,000
	Vegetative Planting				
	5-Gallon Trees	2,000	ea	26.00	52,000
	Wattling	24,000	lf	2.00	48,000
	Riprap	3,000	ton	15.00	45,000
	Subtotal				2,480,500
	Contingencies, ±25 percent				619,500
	Total Channels				3,100,000
30	ENGINEERING AND DESIGN				380,000
31	SUPERVISION AND ADMINISTRATION				260,000
	TOTAL FEDERAL COST				3,740,000

NON-FEDERAL COST

01	LANDS AND DAMAGES				
	Fee Right-of-Way	79	ac	4,300.00	340,000
	Spoil Areas	80	ac	1,900.00	152,000
	Improvements	30	ea	13,300.00	400,000
	Subtotal				892,000
	Damages, 20 percent				177,000
	Relocation Assistance	10	inst	10,000.00	100,000
	Subtotal				1,169,000
	Contingencies, 25 percent				301,000
	Overhead	55	owner	6,000.00	330,000
	Total Lands and Damages				1,800,000
02	RELOCATIONS				
.1	Roads				
	State Highway 53	1	job	L.S.	161,000
	Old Highway 53	1	job	L.S.	142,000
	Subtotal				303,000
	Contingencies, 25 percent				76,000
	Total Roads				379,000
.3	UTILITIES				
	Powerlines	1	job	L.S.	4,000
	Telephone Lines	1	job	L.S.	2,000
	Sanitary Sewer	1	job	L.S.	14,000
	Water Pipe	1	job	L.S.	2,000
	Subtotal				22,000
	Contingencies, 25 percent				5,000
	Total Utilities				27,000
	Total Relocations				406,000
30	ENGINEERING AND DESIGN				60,000
31	SUPERVISION AND ADMINISTRATION				44,000
	TOTAL NON-FEDERAL COST				2,310,000
	TOTAL PROJECT COST				6,050,000

Table F-4

DETAILED COST ESTIMATE
LOWER BASIN (CACHE CREEK)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
	FEDERAL COST				
01	LANDS AND DAMAGES				
	*Fee Right-of-Way	3,600	ac	580.00	2,080,000
	Improvements	1	job	L. S.	50,000
	Relocation Assistance	3	inst	10,000.00	30,000
	Subtotal				2,160,000
	Contingencies, 20 percent				430,000
	Overhead	10	owners	6,000.00	60,000
	*Total Lands and Damages				2,650,000
	**WILDLIFE REFUGE - FACILITIES				560,000
11	LEVEES				
	Clearing and Grubbing	450	acre	150.00	68,000
	Waste Excavation	182,000	cy	0.85	155,000
	Embankment	2,300,000	cy	0.70	1,610,000
	Stabilized Aggregate	18,000	ton	8.50	153,000
	Cobblestone (12")	23,000	ton	15.00	345,000
	Remove, Stockpile, and Reinstall Cobbles	39,000	sy	5.50	214,000
	Seeding	250	acre	400.00	100,000
	Water (Dust Control)	92,000	Mgal	2.00	184,000
	Subtotal				2,829,000
	Contingencies, ± 25 percent				621,000
	Total Levees				3,450,000
15	WEIR				
	Cement	45,000	cwt	3.50	157,000
	Concrete	8,600	cy	180.00	1,548,000
	Steel	1,030,000	lb	0.40	412,000
	Quarrystone (24")	4,700	ton	18.00	85,000
	Quarrystone (18")	4,600	ton	15.00	69,000
	Structure Excavation and Backfill	40,000	cy	7.50	300,000

	Subtotal				2,721,000
	Contingencies, 25 percent				679,000
	Total Weirs				3,400,000
30	ENGINEERING AND DESIGN				820,000
31	SUPERVISION AND ADMINISTRATION				550,000
	*TOTAL FEDERAL COST				11,430,000

*Reimbursement by non-Federal interests would be required for that portion of lands attributed to sediment control. This cost would equal that which would have been required to acquire flowage, sediment deposition, and removal easements on settling basin lands over the 50-year project life should the settling basin lands not have been purchased in fee, and would total $1,800,000.

**Lump sum costs for establishment of refuge facilities were furnished by the U.S. Fish and Wildlife Service and coordinated with the California Department of Fish and Game and were based upon costs incurred in development of similar sized refuges in other areas of the Sacramento basin. Facility costs include such items as ditches, wells, small water control structures, storage shed, tools, and office building.

NON-FEDERAL COST

02	RELOCATIONS				
.3	UTILITIES				
	Storm Sewer Pipes	1	job	L.S.	72,000
	Irrigation Facilities	1	job	L.S.	13,000
	Drainage Facilities	1	job	L.S.	162,000
	Pump, 125 HP	3	ea	22,000.00	66,000
	Subtotal				313,000
	Contingencies, 25 percent				77,000
	Total Utilities				390,000
30	ENGINEERING AND DESIGN				50,000
31	SUPERVISION AND ADMINISTRATION				40,000
	*TOTAL NON-FEDERAL COST				480,000
	TOTAL PROJECT COST				11,910,000

*Does not include reimbursement by non-Federal interests for that portion of lands attributed to sediment control. This amount, totaling

$1,800,000, would equal that cost required to acquire flowage, sediment deposition, and removal easements on settling basin lands over the 50-year project life should the basin lands not have been purchased in fee.

Benefits

Upper Basin (Clear Lake)

7. The purpose of this portion of this section is to furnish flood damage data and to set forth information on the assumptions made and the procedures used in estimating flood damages expected to occur annually, under both current and projected future conditions of development along the Clear Lake rim in Lake County with existing flood control measures and alternative levels of project protection. Tangible damages have been evaluated while intangible damages have not. Tangible damages are those which accrue as a direct result of the flooding and are readily ascertainable on a basis of monetary losses, or increased costs, to individuals or groups, while intangible damages are losses, such as loss of life, impairment of health and living conditions, and psychological problems resulting from floods, that are not readily subject to monetary evaluation. Assumptions, and methodology used in developing average annual damages under preproject conditions, are described in the following paragraphs.

TYPES OF FLOOD DAMAGES

8. Damages caused by flooding within the standard project flood plains were delineated by classes and types of damages and were developed in accordance with terminology contained in ER 1105-2-351 "Evaluation of Beneficial Contributions to National Economic Development for Flood Plain Management Plans." In conformity with these guidelines, tangible damages considered included physical damages resulting from inundation; flood emergency losses or costs incurred in fighting or preparing for flooding; and financial losses resulting from decreased production and increased living and operating costs within the flood plains. Physical damages include damages to, or loss of, buildings; loss of contents, including furnishings, equipment, decorations, stock of materials, materials in process, and inventories; damages to lot improvements including cleanup; damages to roads, parking areas, and bridges. Physical losses are estimated for the following damage categories: residential structures, including lot improvements; residential contents; commercial, including structures, fixtures, and inventory; industrial, including structures, equipment, and inventory; public and semipublic, including structures and contents; roads and parking and other such facilities; and agricultural damages.

9. Residential damages analyzed include those physical damages caused by flooding to residential structures and secondary adjoining buildings and grounds. Costs of emergency measures taken pursuant to flooding are

also included. Residential contents, including household items and personal property, were divided into a separate category from residential structures for purposes of flood damage determination.

10. Commercial damages were computed so as to include physical flood damages to land, buildings, equipment, supplies, merchandise, and other items used in the conduct of commerce, business, trade, services, or entertainment. Also included are costs of emergency actions. Due to the availability of alternative business establishments in surrounding areas, it is assumed that business losses accruing to establishments within the study areas could be compensated through transfer or postponement of sales. Business losses were, therefore, considered but not included.

11. Industrial-utilities damages were analyzed so as to include losses and destruction to industrial and public utilities properties as a result of inundation. Facilities used in extracting, producing, manufacturing, and processing of commodities and heavy warehousing and those involved in distribution are generally classified as industrial. Flood damages to industry are substantially of the same type as those sustained by commercial establishments. Damages to public utilities include losses to all utilities such as railroads, electric and telephone plants, transmission lines, and facilities of like nature.

12. Public facilities damages include tangible damages resulting from inundation of public roads and bridges, streets, sidewalks, highway structures, parks, and other facilities, including equipment and furnishings owned or operated by Federal, State, County, or local governmental units.

13. Other losses to the public include the additional costs incurred during flood emergencies such as evacuation and reoccupation, flood fighting, disaster relief, and extra duty for police, fire, and military units.

14. Agricultural damages include inundation losses to crops, agricultural machinery, fences, wells, and farm buildings. Also included are such other intangible damages as costs of emergency actions.

DEPTH-DAMAGE RELATIONSHIPS

15. Depth-damage relationships describe the probable damages that will occur under different depths of flooding, either as a percentage of the total value of damageable property or in the probable loss expected. In addition to the depth of inundation, other variables which may have a significant impact on the economic damages sustained include the velocity of the water, duration of flooding, and wind-set. Under differing conditions of inundation, these variables will change in

relative importance. Depth of inundation and velocity are major variables governing damages occurring in the lower, Yolo County reaches, while depth of inundation, wind-set, and duration govern damages which would occur to properties along the rim of Clear Lake in any given event.

BUILDINGS, CONTENTS, AND PIERS

16. The depth-damage relationships for buildings, contents, and piers used in this analysis are presented in table F-5. These depth-damage relationships were derived from historic flood surveys and interviews with local officials.

Table F-5

DEPTH DAMAGE

Damage Category	Depth of Flooding From Ground Floor in Feet				
	-1.0	0.1	1.0	2.0	3.0
	Percent Damages				
Clear Lake Rim Reach					
Residential structures	0.0	12.0	28.0	39.0	45.0
Residential contents	0.0	12.0	46.0	65.0	78.0
Mobile home structures	0.0	15.0	66.0	89.0	92.0
Mobile home contents	0.0	12.0	46.0	65.0	78.0
Commercial structures	0.0	12.0	28.0	39.0	45.0
Commercial contents	0.0	12.0	46.0	65.0	78.0
Piers	0.0	2.0	16.0	25.0	52.0
Marina gas facility structures	0.0	2.0	6.0	15.0	31.0
Marina gas facility contents	0.0	2.0	7.0	23.0	40.0

Source: Piers and marina facilities developed from interviews of local marina operators. Remaining categories based on local interviews and historic surveys.

PUBLIC FACILITIES

17. Depth-damage relationships for public facilities such as roads and bridges and for emergency costs are derived from historical survey data and interviews with local officials. Total damage relationships associated with a given hypothetical level of flooding (see following discussion on flow- and stage-damage relationships) are developed for these damage categories rather than specific depth-damage relationships.

AGRICULTURE

18. Agricultural damage relationships are also developed for given hypothetical flood events on the basis of historical flood data from the study and similar areas. Both crop and noncrop damages are estimated. Noncrop damages include debris cleanup and leveling, and damages to improvements such as roads, fences, irrigation systems, and equipment that could not be removed prior to flooding. Noncrop damages are more dependent on the level of improvements common to the area than the particular crops planted.

19. Noncrop damages for improved acreage in the Clear Lake Rim Reach are estimated to average $115, $140, and $165 per acre, respectively, from flooding from the 50-year, 100-year and SPF events. Noncrop damages to native pasture are estimated to average $14 per acre in this reach.

Table F-6

AVERAGE CROP DAMAGES IN DOLLARS PER ACRE

Clear Lake Rim

Crop	50-Year	100-Year	SPF
Orchards	342	369	445
Alfalfa	166 1/	166 1/	166 1/
Truck	-	-	-
Grain	69	69	69
Rice	-	-	-
Native Pasture	Neg.	Neg.	Neg.
Pasture	111 1/	111 1/	111 1/

1/ Includes one-half of the cost for reestablishing stand.

20. In determining average crop damages, consideration is given to planting times and probable timing of flooding as well as the impact of duration and velocity on crop yields. For example, the primary grain crop in the Clear Lake rim area is barley, which is normally planted in late fall or early winter. The expected flooding of agricultural areas from high lake levels would primarily occur in late winter or early spring, after planting had occurred. During a 50-year flood event, the lake level would be expected to exceed 9.0 feet at the Rumsey gage at Lakeport (1327.65 feet, m.s.l. datum) for more than 45 days. Such long-term duration of flooding would be expected to result in complete loss of the barley crop; and the average crop damage, would, therefore, be the gross return per acre less any cultural costs that would no longer be incurred. The 1974 normalized yield for dry-farmed barley in Lake County was 1.4 tons per acre, and the 1974 normalized price was $55.36 per ton for a gross return of approximately $78 per acre. Harvesting

costs of approximately \$9 per acre, based on a University of California Extension Service Study, "Sample Costs of Production," would be the only cultural cost that the farm operator would have not already incurred. Therefore, the average crop damage to barley would be \$78 minus \$9, or \$69 per acre. Similar analyses were used to determine the remaining average crop damages within the study area.

STAGE-DAMAGE AND FLOW-DAMAGE RELATIONSHIPS

21. Stage-damage and flow-damage relationships describe the probable flood damages expected under varying stage elevations (Clear Lake rim). They are derived by estimating the probable flood damages for several hypothetical floods of given stage elevations. Intermediate damage points are interpolated from these estimates on the basis of the proportionate change in stage elevation.

22. The probable flood damages for the hypothetical floods are estimated by identifying the associated flood plain area, inventorying this area by damage category and depth of flooding, and applying the appropriate depth-damage relationship. Probable damages for the 25-year, 50-year, 100-year, and SPF flood events under existing conditions are summarized in table F-7 for the study area.

STAGE- AND FLOW-FREQUENCY RELATIONSHIPS

23. Stage- and flow-frequency relationships describe the probable frequency of occurrence of varying stage elevations or streamflows. These relationships are estimated for both with and without project conditions under present and future hydrologic conditions. The stage frequency relationships used in this analysis are presented in plate E-10.

Table F-7

CLEAR LAKE RIM
PROBABLE 25-YEAR, 50-YEAR, 100-YEAR, AND
STANDARD PROJECT FLOOD DAMAGES 1977 CONDITIONS
AND PRICES
(In Thousands)

Damage Category	25-Year	50-Year	100-Year	SPF
Residential structures 1/	$2,633	$ 3,997	$ 5,929	$ 8,146
Residential contents 1/	1,399	2,175	3,265	4,555
Mobile home structures	255	517	1,000	1,462
Mobile home contents	126	262	539	883
Commercial	2,861	3,863	5,185	6,654
Public facilities	185	246	424	708
Private piers	222	340	499	723
Agriculture	398	563	743	921
Emergency costs	29	43	71	91
Total	$8,108	$12,006	$17,655	$24,143

1/ Excluding mobile homes.

DAMAGE-FREQUENCY RELATIONSHIPS

24. Damage-frequency relationships describe the probable frequency of occurrence of flood damages of varying magnitudes and are derived by combining the stage- or flow-damage and the stage- or flow-frequency relationships.

25. Summarized in table F-8 are selected points from the above relationships under preproject conditions. In this table, columns a and b represent the stage frequency relationships, columns b and c represent the stage damage relationships, while columns a and c represent the damage-frequency relationships.

Table F-8

CLEAR LAKE RIM STAGE AND
DAMAGE FREQUENCY RELATIONSHIPS
PREPROJECT CONDITIONS
1977 CONDITIONS AND PRICES

Frequency as percent chance elevations and damages are equalled or exceeded (a)	Elevation at Rumsey gage (b)	Probable damages 1/ ($1,000) (c)
.1	13.90 feet	26,706
.2	13.30	25,550
.5	12.50	21,986
1.0	11.85	17,655
2.0	11.20	12,224
4.0	10.55	8,339
10.0	9.50	4,085
18.0	8.60	1,817
24.0	8.20	1,020
43.0	7.56	0

1/ Damages computed assuming an average increase of 1 foot in lake elevation resulting from wave action.

For comparative purposes shown below are stage, damage, and frequency relationships for project conditions.

CLEAR LAKE RIM STAGE AND
DAMAGE FREQUENCY RELATIONSHIPS
POSTPROJECT CONDITIONS
1977 CONDITIONS AND PRICES

Frequency as percent chance elevations and damages are equalled or exceeded	Elevation at Rumsey gage	Probable damages 1/ ($1,000)
(a)	(b)	(c)
.1	11.90	17,988
.2	11.25	12,642
.8	9.80	5,300
1.0	9.55	4,288
1.6	9.05	2,951
2.0	8.80	2,321
3.0	8.45	1,518
4.0	8.25	1,120
10.0	7.75	303
12.0	7.56	0

1/ Damages computed assuming an average increase of 1 foot in lake elevation resulting from wave action.

FLOOD INSURANCE

26. The Flood Disaster Protection Act of 1973 (PL 93-234) required communities having flood prone areas to participate in the National Flood Insurance Program by 1 July 1975, or become ineligible for Federally related financing for projects that would be located in such areas. Participation in the flood insurance program requires local adoption and certification by the Flood Insurance Administration of land use regulations that would require, as a minimum, that all new and

replacement residential structures in the 100-year flood plain have their first floor elevated to at or above the 100-year flood elevation and all new or replacement nonresidential structures be flood proofed up to the level of the 100-year flood. In computing preproject damages, it was assumed that the first floor of all future development within the 100-year flood plain would be elevated to the level of the 100-year flood in compliance with the Flood Disaster Protection Act.

RESIDUAL DAMAGES SPF - EVENT

27. Probable residual damages under SPF conditions with the project are presented in table F-9 along with probable preproject damages for comparative purposes.

Table F-9

CLEAR LAKE RIM STANDARD PROJECT FLOOD
PREPROJECT AND RESIDUAL DAMAGES, EXISTING
AND FUTURE CONDITIONS - 1977 PRICES
(In Thousands)

Year	Preproject Damages	Residual Damages 8,000 cfs Channel
1977	$24,322	$10,557
1995	36,828	11,913
2005	43,285	12,454
2015	43,768	12,049
2025	53,068	11,653
2035	55,631	11,981
-	-	-
2085	55,631	11,981

AVERAGE ANNUAL DAMAGES

28. Average annual damages are the expected value of damages for a given economic condition and point in time. They are determined by weighting the estimated damages from varying degrees of flooding by their probability of occurrence and may be approximated by measuring the area under the damage-frequency curve using standard computerized integral procedures. Average annual flood damages computed for Clear Lake rim under existing conditions and 1977 prices are $1,338,900.

PREPROJECT FLOOD DAMAGES

29. Probable average annual damages without the proposed project were estimated for the present year, the base year, and annually throughout the study period and were based on the fact that all future development would be constructed with first floor above the 11.85-foot elevation, plus wind and wave effect. Average annual equivalent damages for the period 1985-2085 were estimated on the basis of a 6-5/8 percent interest rate, October 1977 prices, and standard discounting procedures. No growth was estimated in the flood plains after 2035. Also, the effects of the National Flood Insurance Program and affluence were evaluated in arriving at the flood damage determinations. Preproject damages are presented in table F-10.

Table F-10

CLEAR LAKE RIM - PREPROJECT DAMAGES, 1977 PRICES
(In Thousands)

	1977	1985	1995	2005	2015	2025	2035	-	2085	Average Annual Equiv. 1985-2085 @ 6-5/8
Residential Structures1/	$ 415.9	$ 435.5	$ 435.5	$ 422.8	$ 383.0	$ 341.4	$ 359.0	-	$ 359.0	$ 418.5
Residential Contents1/										
Without affluence	215.3	223.4	221.3	212.3	187.6	162.3	171.0	-	171.0	210.7
(With affluence)	(215.3)	(285.9)	(374.7)	(427.5)	(377.8)	(326.9)	(344.3)	-	(344.3)	(358.6)
Mobile Home Structures	47.7	51.6	27.2	29.7	33.0	34.6	34.6	-	34.6	34.9
Mobile Home Contents										
Without affluence	24.9	26.9	13.9	15.2	16.8	17.6	17.6	-	17.6	18.0
(With affluence)	(24.9)	(26.9)	(13.9)	(15.2)	(16.8)	(17.6)	(17.6)	-	(17.6)	(18.0)
Commercial	493.5	447.2	375.2	312.1	250.4	206.0	177.1	-	177.1	347.6
Public Facilities	39.1	42.4	47.5	53.3	59.8	67.0	75.1	-	75.1	51.2
Private Piers	36.8	40.8	44.3	47.0	49.7	51.5	51.5	-	51.5	45.3
Agriculture	60.6	62.7	65.9	69.2	72.7	76.4	80.3	-	80.3	67.8
Emergency costs	5.1	5.8	6.9	8.2	9.7	11.6	13.7	-	13.7	7.8
Total										
Without affluence	$1,338.9	$1,336.3	$1,237.7	$1,169.8	$1,062.7	$ 968.4	$ 979.9	-	$ 979.9	$1,201.8
With affluence	$1,338.9	$1,398.8	$1,391.1	$1,385.0	$1,252.9	$1,133.0	$1,153.2	-	$1,153.2	$1,349.7

1/ Excluding mobile homes.

30. Estimates of potential flood damages under existing and probable future conditions were made for each land use category for each reach. Estimated future damages were based on relationships developed from data presented in preceding paragraphs and expected changes in development projected for the flood plains. Growth of new units was determined from county plans, county population projections, and land availability within the flood plains. Existing units were theoretically replaced in the future based on an expected life period. Replacement ratios were based on data from the 1970 Census of Housing pertaining to the distribution of structures by year built. Replacement of those obsolete units was assumed to occur immediately. The changes in annual damages over time, as seen in table F-11, are due to a number of offsetting factors. Increases result from greater numbers of new homes expected in the future and higher values of new and replacement units based on 1977 prices and conditions. Decreases are a result of implementation of the Flood Disaster Protection Act of 1973. The mobile home damage category is a good example of the above factors. Increases occurred in the first decade due to projected new units. However, considering a short replacement cycle of 15 years, all mobile homes in the flood plain by the study year would be phased out and replaced by 1995. Since replacement units would be flood proofed, damages would be reduced considerably. Increases due to new units would continue to occur in the future, but the effect would be minor, since all new units would be above the 100-year flood plain.

RESIDUAL DAMAGES

31. The trends occurring with the average annual damages under preproject conditions would also occur under project conditions, since residual damages are the average annual primary damages remaining under the "with project" condition.

Table F-11

CLEAR LAKE RIM - RESIDUAL DAMAGES 1977 PRICES
(In Thousands)

	1977	1985	1995	2005	2015	2025	2035	-	2085	Average Annual Equiv. 1985-2085 @ 6-5/8
8,000 cfs Channel										
Residential Structures1/	$ 56.7	$ 57.6	$ 56.2	$ 52.8	$ 44.9	$ 37.0	$ 38.8	-	$ 38.8	$ 52.7
Residential Contents1/										
Without affluence	28.1	28.5	27.7	25.8	21.6	17.4	18.3	-	18.3	25.8
(With affluence)	(28.1)	(36.5)	(46.8)	(52.0)	(43.5)	(35.1)	(36.9)	-	(36.9)	(43.7)
Mobile Home Structures	6.0	6.2	2.6	2.7	2.8	2.9	2.9	-	2.9	3.5
Mobile Home Contents										
Without affluence	3.0	3.1	1.2	1.2	1.3	1.4	1.4	-	1.4	1.7
(With affluence)	(3.0)	(3.1)	(1.2)	(1.2)	(1.3)	(1.4)	(1.4)	-	(1.4)	(1.7)
Commercial	77.3	69.3	56.9	46.3	35.9	28.6	24.0	-	24.0	52.4
Public Facilities	6.3	6.9	7.7	8.6	9.7	10.8	12.2	-	12.2	8.3
Private Piers	5.2	5.8	6.3	6.6	7.0	7.3	7.3	-	7.3	6.4
Agriculture	8.6	8.9	9.4	9.8	10.3	10.9	11.4	-	11.4	9.6
Emergency Costs	.7	.9	1.0	1.2	1.4	1.7	2.0	-	2.0	1.2
Total: Without affluence	$191.9	$187.2	$169.0	$155.0	$134.9	$118.0	$118.3	-	$118.3	$161.6
With affluence	$191.9	$195.2	$188.1	$181.2	$156.8	$135.7	$136.9	-	$136.9	$179.5
5,000 cfs Channel										
Without affluence	$423.0	$417.7	$383.9	$359.1	$321.4	$271.4	$291.7	-	$291.7	$370.7
With affluence	$423.0	$435.8	$428.2	$420.8	$375.5	$335.2	$340.4	-	$340.4	$413.1
11,000 cfs Channel										
Without affluence	$120.7	$116.0	$102.4	$ 92.1	$ 77.0	$ 64.2	$ 63.7	-	$ 63.7	$ 96.9
With affluence	$120.7	$120.9	$113.9	$107.3	$ 88.8	$ 72.9	$ 72.8	-	$ 72.8	$107.2

1/ Excluding Mobile Homes.

FLOOD DAMAGE REDUCTION BENEFITS

32. Inundation reduction benefits for the selected plan were estimated by evaluating damages with and without the proposed project. Primary tangible flood damage reduction benefits for the plans are the difference between the equivalent average annual flood losses without the project and the residual average annual losses with the project. Economic criteria and projections used in arriving at the benefit estimates encompass recent evaluation guidelines including ER 1105-2-351, the Flood Disaster Protection Act of 1973, and the Water Resources Development Act of 1974. Inundation reduction benefits attributable to the selected plan are summarized in table F-12.

METHODOLOGY FOR COMPUTING FLOOD DAMAGE REDUCTION BENEFITS

33. The following is a brief description of the procedures followed in the computation of flood damages and benefits around Clear Lake. Since flooding on the rim is principally due to runoff from high-intensity storms, the area was analyzed as one reach, using one preproject stage-frequency curve. The stage-frequency relationships used in this analysis are presented in plate E-10. Once obtained, flood plains were developed for various flood frequencies. A lake stage was then calculated for each event and an inventory was made of all improvements located within the specified flood plain. Types of damage categories are described in paragraphs 8 through 14. A depth-damage relationship

Table F-12

CLEAR LAKE RIM - BENEFITS 1977 PRICES
(In Thousands)

	1977	1985	1995	2005	2015	2025	2035	-	2085	Average Annual Equiv 1985-2085 @ 6-3/8
8,000 cfs Channel										
Residential Structures1/	$ 359.2	$ 377.9	$ 379.3	$ 370.0	$ 338.1	$ 304.4	$ 320.2	-	$ 320.2	$ 365.8
Residential Contents1/										
Without affluence	187.2	194.9	193.6	186.5	166.0	144.9	152.7	-	152.7	$ 184.9
(With affluence)	(187.2)	(249.4)	(327.9)	(375.5)	(334.3)	(291.8)	(307.4)	-	(307.4)	(314.9)
Mobile Home Structures	41.7	45.4	24.6	27.0	30.2	31.7	31.7	-	31.7	31.4
Mobile Home Contents										
Without affluence	21.9	23.8	12.7	14.0	15.5	16.2	16.2	-	16.2	16.3
(With affluence)	(21.9)	(23.8)	(12.7)	(14.0)	(15.5)	(16.2)	(16.2)	-	(16.2)	(16.3)
Commercial	416.2	377.9	318.3	265.8	214.5	177.4	153.1	-	153.1	295.2
Public Facilities	32.8	35.5	39.8	44.7	50.1	56.2	62.9	-	62.9	42.9
Private Piers	31.6	35.0	38.0	40.4	42.7	44.2	44.2	-	44.2	38.9
Agriculture	52.0	53.8	56.5	59.4	62.4	65.5	68.9	-	68.9	58.2
Emergency Costs	4.4	4.9	5.9	7.0	8.3	9.9	11.7	-	11.7	6.6
Total: Without affluence	$1,147.0	$1,149.1	$1,068.7	$1,014.8	$ 927.8	$ 850.4	$ 861.6	-	$ 861.6	$1,040.2
With affluence	$1,147.0	$1,203.6	$1,203.0	$1,203.8	$1,096.1	$ 997.3	$1,016.3	-	$1,016.3	$1,170.2
5,000 cfs Channel										
Without affluence	$ 915.9	$ 918.6	$ 853.8	$ 810.7	$ 741.3	$ 697.0	$ 688.2	-	$ 688.2	$ 831.1
With affluence	$ 915.9	$ 963.0	$ 962.9	$ 964.2	$ 877.4	$ 797.8	$ 812.8	-	$ 812.8	$ 936.6
11,000 cfs Channel										
Without affluence	$1,218.2	$1,220.3	$1,135.3	$1,077.7	$ 985.7	$ 904.2	$ 916.2	-	$ 916.2	$1,104.9
With affluence	$1,218.2	$1,277.9	$1,277.2	$1,277.7	$1,164.1	$1,060.1	$1,080.4	-	$1,080.4	$1,242.5

1/ Excluding Mobile Homes.

was defined either as a percentage of the total value of damageable property or as a probable loss expected (see paragraphs 15 through 20). A stage-damage relationship was then derived, defining damages for various flood levels (see paragraph 21). Combining the stage-damage curve with the stage-frequency curve produced the damage-frequency curve. Plate F-2 shows a schematic representation of these relationships under existing conditions. The curves may not exactly compare with the values listed in the report, since this is merely an illustration, while the actual values are calculated via computer program. Average annual residual damages were then estimated following the same procedures used in the calculation of average annual preproject damages. As noted in paragraph 32, average annual flood damage reduction benefits are the difference between average annual preproject and average annual project damages.

FLOOD PROOFING ANALYSIS

34. As a preproject condition, all new and replacement structures would be constructed with their first floor above the 11.85-foot elevation (Rumsey gage), plus wind and wave effect, in compliance with the current Lake County zoning ordinances. The estimate of average annual equivalent residual damages previously presented ($179,500) was based on the continuation of this ordinance for the following economic reason. If the ordinance was discontinued, with project construction new development would be allowed to build at the new 100-year level (9.55

feet). Average annual equivalent residual damages assuming new and replacement development to the postproject 100-year level are estimated to be $309,100, an increase of $129,600. The average annual equivalent cost associated with providing the flood proofing is estimated to be $65,300. Thus, the incremental benefit-cost ratio of requiring future development to continue to build at or above the elevation of the preproject 100-year flood plane elevation of 11.85 feet is 2.0 to 1. Table F-13 lists the number of future units by decade, the depth of flood proofing needed, and the cost for such a requirement. The unit costs are based on square footage estimates from the regional area. Average annual and average annual equivalent costs of flood proofing are summarized in table F-14.

35. Since flood proofing will be required to continue to its present level (11.85 feet) with the project, savings in flood proofing costs cannot be taken as a project benefit. However, benefits are accrued as a result in the reduction of residual damages.

36. A summary of average annual flood damage reduction benefits on Clear Lake rim for existing and future inundations is shown in the following tabulation. Amounts shown do not include NED employment benefits.

Existing (1977) Conditions	$1,147,000
Base Year (1985) Conditions	1,203,600
Average Annual Equivalent (1985-2035)	1,170,200

Table F-13

FLOOD PROOFING UNITS

	Depth of Fill (ft)	Cost Per Unit 1977 Prices	Units at End of Decade 1985 1/	1995	2005	2015	2025	2035	2035-2085 2/
Residential	2.1	$5,000	0	19	18	26	23	7	-
1,100 sq ft	1.9	4,600	0	33	36	57	52	8	-
	1.4	3,400	0	25	25	39	33	7	-
	0.9	2,300	0	28	30	46	45	8	-
	0.4	1,000	0	37	35	47	41	15	-
Mobile Homes	2.1	2,500	0	8	-	-	-	-	-
	1.9	2,300	0	11	-	-	-	-	-
	1.5	1,800	0	9	-	-	-	-	-
	0.9	1,200	0	44	-	-	-	-	-
	0.7	1,000	0	5	-	-	-	-	-
Commercial - Motels									
4,000 sq ft	2.1	8,500	0	3	2	2	-	-	-
	1.9	7,700	0	3	3	3	3	-	-
	0.9	3,700	0	3	4	5	3	3	-
Commercial - Misc.									
2,000 sq ft	2.1	7,800	0	5	5	5	6	6	-
	1.9	7,100	0	5	5	5	5	6	-
	0.9	3,500	0	5	5	7	7	5	-

1/ Flood proofing would be required prior to the project base year, 1985, and the cost of such flood proofing is not considered as a project benefit.
2/ No development is projected beyond 2035.

Table F-14

FLOOD PROOFING COSTS - 1977 PRICES ($1,000)

	Average Annual Costs of Flood Proofing							Average Annual Equivalent Costs
	1985 1/	1995	2005	2015	2025	2035	2035-2085 2/	@ 6-5/8%
Residential	-	43.3	44.5	67.8	61.1	12.9	-	45.3
Mobile Homes	-	11.9	-	-	-	-	-	5.7
Commercial	-	15.2	14.7	15.8	14.1	11.8	-	14.3
Total	-	70.4	59.2	83.6	75.2	24.7	-	65.3

1/ Flood proofing would be required prior to the project base year, 1985, and the cost of such flood proofing is not considered as a project benefit.
2/ No development is projected beyond 2035.

ECONOMIC SENSITIVITY ANALYSIS OF WAVE RUNUP AND WIND SETUP

37. All calculations and tabulations of damages and benefits in this report are based on a 1-foot average wave runup and wind setup. As discussed in Section C, a sensitivity analysis was made for various other levels of wave runup and wind setup. The following tabulation shows average annual equivalent preproject and residual damages and project benefits for wave runup and wind setup of 0.5, 1.0, and 1.5 feet.

SENSITIVITY EFFECT OF WIND SETUP AND WAVE RUNUP

	Height		
	0.5 feet	1.0 feet	1.5 feet
Preproject Damages 1/	827,900	1,349,700	1,534,700
Residual Damages 1/	98,300	179,500	211,400
Inundation Reduction Benefits	729,600	1,170,200	1,323,300

1/ All new and replacement units would be required to flood proof to the preproject 100-year level.

NATIONAL ECONOMIC DEVELOPMENT - EMPLOYMENT BENEFITS

38. The Area Redevelopment Act, Public Law 87-27, 87th Congress, 1st Session, and its successor, the Public Works and Economic Development Act of 1965, Public Law 89-136, 89th Congress, provide for the Federal Government to cooperate with the states to help areas of substantial and persistent unemployment and underemployment and to take effective steps

in planning and financing their economic development. Federal assistance should enable such areas to enhance the domestic prosperity by creation of new employment opportunities through development and expansion of new and existing facilities and resources. The role of the Corps of Engineers in the program is set forth in ER 1165-2-6, dated 1 February 1966, which also specifies the criteria to be used for project formulation and evaluation. It states that in addition to the criteria now in use, estimates of benefits may include an amount equivalent to that part of the construction costs which represents wages to workers who, in the absence of the project, would be unemployed. Lake County has been designated as eligible for assistance under the administration of the U.S. Department of Commerce.

39. The estimation of area redevelopment benefits for the selected plan is summarized in the following paragraphs. The NED employment benefits have been included in the benefit-cost ratio analysis presented in Section D.

40. NED employment benefits attributable to a project are equal to wages paid to local workers during construction who, during the absence of the project, would most likely be unemployed. Evaluation of construction costs of projects in California similar to the proposed plan indicates that about 32 percent of the Federal construction costs represent labor costs with about 45 percent of the labor provided by local workers, primarily from unskilled and semiskilled labor pools.

41. Based on Federal construction costs of $3,740,000 for the project and the above assumptions, the total labor costs would be about $1,196,800 and local labor costs about $538,600.

42. Assuming an average salary of $26,000, the project would provide employment for about 21 local workers, who could be readily provided by the local unemployed labor force. Based on a 6-5/8 percent interest rate and a 100-year discounting period, the average annual equivalent value of the NED employment benefit would be $35,700 for this alternative. The costs for operation, maintenance, and replacement were not included in the computation of employment benefits.

Lower Basin (Cache Creek)

43. Benefits to the selected plan of improvement in lower Cache Creek Basin are realized through control of sediment and associated flooding, wildlife enhancement, and NED employment. These areas of benefit are described in detail in the following paragraphs.

SEDIMENT CONTROL

44. A failure to control Cache Creek sediment will endanger the integrity of the Sacramento River Flood Control Project. A determination of economic benefits associated with sediment control is explained in following paragraphs of this section. However, it should be pointed out that in a previous project specifically authorized and

constructed to protect the Sacramento River Flood Control Project, the Board of Engineers for Rivers and Harbors in its report to the Chief of Engineers dated 18 February 1960, subject: Sacramento River, California, Bank Protection, stated the following:

"The Board considers that the remedial work is clearly justified to preserve the integrity of the existing levee system, the failure of any part of which would endanger lives and cause extensive property damage. The improvements would also reduce the need for emergency expenditures and the costs of maintenance dredging for navigation and flood-control channels. The Board considers it impracticable to assign a monetary value to the benefits which would result from the removal of threats of eventual levee breaks when there are hundreds of vulnerable locations in various states of deterioration."

The Board's report can be found on pages 3 thru 8 of Senate Document No. 103, 86th Congress, 2d Session.

45. It is reasonable to assume that a similar approach can be used in justifying sediment control improvements in lower Cache Creek Basin. However, as previously mentioned, the following paragraphs describe in detail the traditional approach to economic justification of the proposed works.

ANALYSIS

46. Benefits attributed to sediment control can be separated into two main categories. First, by controlled deposition of sediment in the Cache Creek Settling Basin, damages that may have occurred due to deposition in the Yolo Bypass and induced flooding elsewhere are prevented. Secondly, by control of sediment, reduced downstream dredging requirements are realized.

FLOOD DAMAGE PREVENTION

47. If sediment were allowed to continue to deposit in the Yolo Bypass, damage to development in the bypass would occur, and in addition, a backwater effect would be created which would cause infringement of the design flow on freeboard of the Yolo Bypass, Knights Landing Ridge Cut, and a portion of the Sacramento River. It would be necessary, in that case, to strengthen these levees and restore freeboard requirements. If sediment were controlled and caused to deposit upstream of the Yolo Bypass, there would be a benefit in so doing, as defined in the following analysis.

48. Sediment depositing in the Yolo Bypass in the vicinity of the Cobble Weir would inundate and render useless 435 acres of industrial waste oxidation ponds owned by the city of Woodland. The first cost to replace this facility is $840,000, the average annual cost of which is

$55,600. The 2,100 acres of agricultural land over which this sediment would deposit would not suffer significant losses in productivity. However, backwater effects caused by the sediment obstruction would be significant. The Yolo Bypass levees would need to be raised a maximum of 2.2 feet from 0.8 mile downstream of Interstate 5 upstream to the Fremont Weir, at a first cost of $2,894,000 and an average annual cost of $210,800. The Knights Landing Ridge Cut levees would need to be raised 1.8 feet at a first cost of $1,377,000 and an average annual cost of $101,900. Since backwater effects are still significant at the Fremont Weir, Sacramento River levees would need to be raised from that location downstream to the Sacramento Bypass at a first cost of $10,800,000 and an average annual cost of $746,000. The total first cost for such an activity, necessary to preserve the integrity of the Sacramento River Flood Control Project in the project area and prevent damages to development in the Yolo Bypass, would be $15,861,000, the average annual cost of which would be $1,114,300. This analysis is based on October 1977 price levels, a 6-5/8 percent discount rate, and a 50-year period of analysis.

49. To insure a conservative estimate of benefits, it is also necessary to examine flood damages that could occur should freeboard requirements not be reestablished on the levees previously described. If these average annual flood damages incurred were less than $1,114,300, this new figure should be used as a basis for benefits in keeping with the theory of "least costly alternative" analysis. Derivation of this

figure is described in the paragraphs below. Excavation of 100 acre-feet of sediment annually from the Yolo Bypass as a possible least-costly alternative was evaluated. The deposited sediment would be spread over thousands of acres of agricultural land over a period of years. Excavation over such a vast land area would not be practical and thus was not studied in detail.

50. Failure of the Sacramento River Flood Control Project could conceivably occur at any of an infinite number of locations in the project area. The following six areas were selected as being representative.

Location of Failure	Acres Inundated
1. Yolo Bypass: Right Bank	12,340
2. Yolo Bypass: Left Bank Sacramento River: Right Bank	12,300
3. Settling Basin: Right Bank	440
4. Knights Landing: Right Bank	7,780
5. Knights Landing: Left Bank	3,490
6. Sacramento River: Left Bank	53,330

51. Of these six areas, the first and last were evaluated in order to show the wide range of damages and benefits which could be experienced if the project failed. The right bank of the Yolo Bypass contains essentially 100 percent agriculture, while the left bank of the Sacramento River has an increasingly high level of residential, commercial, and industrial properties.

52. The Yolo Bypass, right bank, has 12,340 acres in its flood plain. The only major land use is agriculture, principally corn, grain, rice, and tomatoes. It was estimated that losses from a levee break would exceed $6 million, due to loss of production, loss of variable costs expended, and cleanup. Assuming a constant level of protection, average annual and average annual equivalent damages for the 50-year period are $31,000. A linear increase in water elevation in the Yolo Bypass results in an increase of damages over time. Average annual equivalent damages, at 6-5/8 percent, are $65,800. The difference, or benefit to the project, is $34,800 annually.

53. Potential damages from a levee break on the left bank of the Sacramento River are extremely high due to the high level of urban development in the area. Over 53,000 acres would be inundated from a break, with depths of flooding over 10 feet in much of the area.

54. A breakdown of land use and estimated losses, under existing conditions, is summarized below:

Land Use	Acres	Total Damages
Agriculture	50,685	$ 28,000,000
Residential	1,226	217,000,000
Commercial	29	7,000,000
Schools	58	5,000,000
Industrial	139	213,000,000
Airport	657	60,000,000
Vacant	536	-
Total	53,330	$530,000,000

55. Over 95 percent of the area is agriculture, yet the majority of damages are from urban losses. High concentrations of damages occurred since most improvements were considered a total loss due to the high level of flooding and duration. Average annual equivalent damages under preproject conditions are $5,621,000, while damages under project conditions are $2,650,000. This is based on a linear increase of 1 foot in water surface elevation in the Sacramento River over 50 years and results in an increase in damages over time. The difference, or benefit to the project, is $2,971,000 annually. Furthermore, benefits are conservative since future growth was not considered, nor were losses to air and road travel delays accounted for.

56. Analysis showed that the probability of failure at any of these six locations was about the same. Since average annual flood damages from failure could be as high as $2,650,000, and it would require an average annual cost of only $1,114,300 to maintain freeboard requirements and thus prevent this damage, the latter figure was used as a basis for flood prevention benefits associated with sediment control upstream of the Yolo Bypass.

REDUCED DOWNSTREAM DREDGING REQUIREMENTS

57. Extensive analysis by the State of California Department of Water Resources has determined that, without upstream control, 100 acre-feet of sediment will annually deposit adjacent to the Cobble Weir in the

Yolo Bypass. These studies are discussed in the Department's October 1972 Memorandum Report entitled "Cache Creek Settling Basin Interim Plan" and the December 1968 Memorandum Report entitled "Investigation of Alternative Plans for Control of Sediment from Cache Creek." That portion of Cache Creek's sediment load which would not deposit in the Yolo Bypass in the immediate vicinity of the Cobble Weir, 85 percent of the total, or about 575 acre-feet per year, would continue downstream to its eventual destination. Sieve analysis from Suisun Bay indicates that nearly all of the material entering the San Francisco Bay system is smaller than about 0.5 mm in size. It was, therefore, assumed that all of the 575 acre-feet of material described above composed of the larger sand materials would deposit in the Sacramento River system above the Suisun Bay, a quantity amounting to about 88 acre-feet annually. The remaining amount of about 487 acre-feet, composed of silts and clays, annually would enter the San Francisco Bay system. Independent studies by the Corps of Engineers in 1965 and the University of California at Davis in 1966 indicate that about 40 percent of the material entering the Bay system would deposit therein, with the remaining 60 percent exiting the Bay system into the Pacific Ocean. From this, 40 percent of 487 acre-feet (or about 195 acre-feet) of sediment from Cache Creek would annually deposit in the Bay system. Based on consultant studies by Dr. Vito Vanoni in 1977 on the Sacramento River, Chico Landing to Red Bluff, California, project, only 12 percent of the 195 acre-feet depositing in the bay system would require dredging. The 12 percent figure is based upon the ratio of the

area of the navigation channel to the total tidal channel. This analysis is conservative since it essentially ignores resuspension. Following is a discussion of this issue which concludes that if resuspension were considered, sediment control benefits would be greater. It is first necessary to explain the seasonal movement of material that may have initially deposited in some of the shallower areas of the Bay where no dredging is required. This rationale was earlier presented in the December 1975 final environmental statement by the San Francisco District of the Army Corps of Engineers, entitled "Maintenance Dredging - Existing Navigation Projects, San Francisco Bay Region, California." During the winter months wave suspension of sediment is at a minimum, allowing the sediment to accumulate in these shallow areas. In the spring and summer months, daily on-shore breezes generate waves over the shallow areas, resuspending recently deposited sediments and maintaining them in suspension, while tidal and wild-generated currents circulate them throughout the Bay. The suspended sediment is repeatedly deposited and resuspended in the shallow areas until it is finally deposited in deeper water below the effective depth of wave influence. In spring and summer there is a net movement of sediment from the shallow repository areas, bringing the shallows back to a profile of equilibrium where wave action is no longer influential in resuspending the sediment. Once the sediment reaches deeper water, usually in natural channels or along the margin of these channels, tidal currents become the primary transporting mechanisms. Like the shallow areas (the depths of which are in equilibrium with the depth of effective wave action), the depth of the

natural channels is in equilibrium with the flow volume and velocity in the channel. It is from these deeper channels that the sediment is eventually dredged. Table F-15 summarizes the location and amounts of deposition of Cache Creek sediments if no measures are taken to prevent its discharge into the Yolo Bypass.

Table F-15

CACHE CREEK SEDIMENT DEPOSITION (ANNUAL)
WITHOUT UPSTREAM CONTROL

Location of Deposition	Amount of Deposition (Acre-ft)	% of Total
Cache Creek Settling Basin	0	0
Yolo Bypass Adjacent to Cobble Weir	100	15
Sacramento River System (Yolo Bypass, Sacramento River, and Ship Channels)	88	13
San Francisco Bay System (outside navigation channel)	172	25
San Francisco Bay System (within navigation channel)	23	4
Pacific Ocean	292	43
Total	675	100

58. The proposed project would establish a 50 percent sediment trap efficiency behind the Cobble Weir, thus allowing 50 percent of Cache Creek's sediment load, or about 335 acre-feet annually, to be carried into the Yolo Bypass and downstream. Utilizing the same analysis described in the previous paragraph, table F-16 indicates the location and amounts of deposition of this 335 acre-foot quantity.

Table F-16

CACHE CREEK SEDIMENT DEPOSITION (ANNUAL)
WITH UPSTREAM CONTROL

Location of Deposition	Amount of Deposition (Acre-ft)	% of Total
Cache Creek Settling Basin	340	50
Yolo Bypass Adjacent to Cobble Weir	0	0
Sacramento River System (Yolo Bypass, Sacramento River, and Ship Channels)	0	0
San Francisco Bay System (outside navigation channel)	118	17
San Francisco Bay System (within navigation channel)	16	3
Pacific Ocean	201	30
Total	675	100

59. Reduced sediment dredging requirements that can be attributed to the proposed plan are shown in table F-17 and are equal to the difference between those quantities shown in tables F-15 and F-16, less those quantities deposited in the Yolo Bypass adjacent to the Cobble Weir and in the Pacific Ocean where no dredging occurs. The mass distribution of sediment with and without the project is illustrated on plate F-3.

Table F-17

REDUCED DREDGING REQUIREMENTS (ANNUAL)
WITH PLAN OF IMPROVEMENT

Location of Reduced Dredging	Amount of Reduced Dredging (Acre-ft)
Sacramento River System (Yolo Bypass, Sacramento River, and Ship Channels)	88
San Francisco Bay System (within navigation channel)	7
Total	95

60. The following estimates, based upon costs for current dredging activities in the subject areas, were made for the cost per cubic yard of dredged sediment.

Sacramento River System $1.80

San Francisco Bay System $1.20

Based upon the amount of reduced sediment deposition in these two areas, a weighted average cost of $1.75 per cubic yard was used for dredging reduction requirements associated with the proposed plan. Applying this average cost to the quantities shown in table F-17, an average annual savings of $268,000 would be realized with this plan.

NATIONAL ECONOMIC DEVELOPMENT EMPLOYMENT BENEFITS

61. Sacramento County has been officially designated as a Title IV redevelopment area as of 23 April 1976. As an area of substantial unemployment, it qualifies for Federal assistance under Public Law 89-136.

62. The city of Sacramento and nearby communities form a large metropolitan area and as such maintain a high level of unemployed. The Cache Creek Settling Basin is within reasonable commute distance to this urban area; and as a result, NED employment benefits have been included for the project.

63. As mentioned earlier, NED employment benefits attributable to a project are equal to wages, during construction, to local workers who, in the absence of the project, would most likely be unemployed. Of the total Federal construction costs, 32 percent represents labor costs, and 45 percent of the labor was assumed to be local labor, primarily at the unskilled and semiskilled levels.

64. Based on Federal construction costs of $8,220,000 for the Cache Creek Settling Basin project and the above assumptions, the total labor costs would be about $2,630,400 and local labor costs about $1,183,700.

65. Assuming an average salary of $26,000, the project would provide employment for about 45 local workers. Based on a 6-5/8 percent interest rate and a 50-year discounting period, the average annual equivalent value of the NED employment would be $81,700. The costs for operation, maintenance, and replacement were not included in the computation of employment benefits.

WILDLIFE ENHANCEMENT

66. Wildlife enhancement benefits associated with establishment of a wildlife refuge over the 3,600-acre Cache Creek Settling Basin have been provided by the U.S. Fish and Wildlife Service and coordinated with the California Department of Fish and Game. Monetary benefits attributed to hunter and visitor use were compiled in accordance with the Water

Resources Council's "Principles and Standards for Planning Water and Related Land Resources."

67. The location of the proposed refuge would provide critically important wintering habitat for Pacific Flyway waterfowl. In terms of migratory bird use, 4.6 million waterfowl use days and 108,000 shore and marsh bird use days can annually be attributed to the refuge. In addition, the increased wetland habitat development would allow for improved distribution of wintering waterfowl in the Central Valley, reducing crop depredation losses and bird losses due to disease.

68. The proposed refuge would complement the Fish and Wildlife Service's operations at Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges and the California Department of Fish and Game's refuge at Gray Lodge, and Grizzly and Joice Islands. The refuge would, as a result, contribute significantly to the further implementation of the National Migratory Bird Management Program. In terms of monetary benefits, the U.S. Fish and Wildlife Service has determined that all costs associated with establishing the refuge may be properly considered as a direct positive benefit to waterfowl and are fully offset by increased bird use days and the refuge's contribution to the U.S. Fish and Wildlife National Migratory Bird Management Program. These annual benefits total $282,000 and represent the least costly alternative means of establishing a similar refuge supporting equivalent bird use in Yolo County.

69. Additional benefits to be gained as a result of development of the refuge include reduction in crop depredation losses and increased hunting and general recreation opportunities. Crop depredation benefits total $75,000. Hunting would provide for a net increase of 7,450 recreation days at $9 per day, totaling $67,000. Additionally, approximately 39,000 recreation days (at $2/day) would create $78,000 in annual benefits.

70. Total annual wildlife enhancement benefits are summarized below:

	Benefits
Reduced disease losses and contribution to the National Waterfowl Management Program (Discounted 6-5/8%)	$282,000
Reduced Crop Depredation	75,000
Hunting	67,000
Visitation	78,000
	$502,000

Table F-2 indicates that average annual costs attributed to the wildlife refuge total $222,400. As tabulated above, average annual wildlife enhancement benefits total $502,000. Thus, the incremental benefit-cost ratio of the wildlife refuge is 2.3 to 1.

Summary of Benefits

71. Shown in table F-18 below is a summary of average annual benefits associated with water resource related improvements in the upper and lower Cache Creek Basin. It should be noted that a potential project benefit exists for revenue that could be obtained by the sale of 50,000 cubic yards of sediment annually to topsoil distributors. However, such a benefit has not been claimed since it is assumed that any benefit would be offset by costs of removal.

Table F-18

SUMMARY OF BENEFITS

Upper Basin	
Flood Control	$1,170,200
NED Employment	35,700
Total	1,205,900
Lower Basin	
Flood Control	1,114,300
Sediment Control	268,000
NED Employment	81,700
Wildlife Enhancement	502,000
Total	1,966,000
Project Total	3,171,900

Justification

72. Comparison of the average annual benefits with the average annual costs is tabulated below. Although intangible benefits and tangible secondary benefits may accrue to the national economy, only tangible primary benefits are included in the tabulation.

AVERAGE ANNUAL COSTS AND BENEFITS

Upper Basin (Clear Lake)	
Annual Costs	$ 413,000
Annual Benefits	1,205,900
Benefit-Cost Ratio	2.9 to 1
Lower Basin (Cache Creek)	
Annual Costs	$966,000
Annual Benefits	1,966,000
Benefit-Cost Ratio	2.0 to 1

Maximization

73. Maximizing net tangible benefits is an economic concept used in sizing facilities to produce the greatest excess of benefits over costs. Under this concept, the last increment in the project size

produces an incremental benefit-cost ratio equal to 1.0 to 1, and further increases in size would be uneconomical. Plate F-1 shows that enlargement of the Clear Lake Outlet Channel optimizes at 8,000 cubic feet per second; i.e., the greatest excess of benefits over costs is found at that size enlargement.

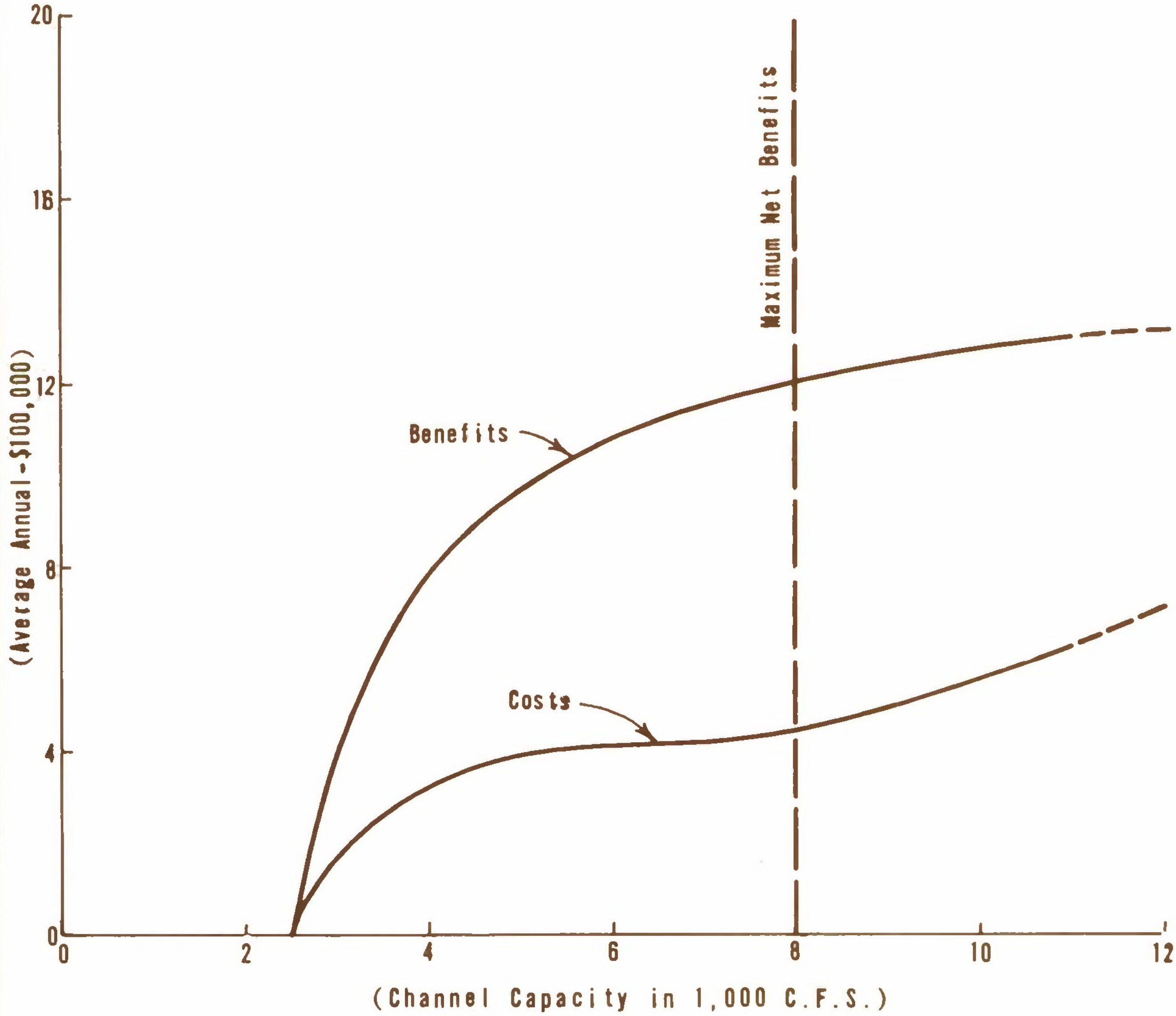
74. A 50-year project life is considered reasonable and was selected for the Cache Creek Settling Basin since storage of sediment in excess of that which would accumulate in 50 years would create the following additional problems:

- The County Road 102 highway structure would have to be replaced since backwater effects caused by accumulated sediment would eliminate the necessary freeboard under the existing structure.

- Backwater effects would be felt in other areas further upstream, requiring extension of existing project levees upstream.

- With a 50-year project life, the perimeter levees of the settling basin would average 20 feet in height. A longer project life would necessitate these levees being raised even higher which is not desirable in light of the proximity to the settling basin of the city of Woodland, interstate highway and railroad facilities, and highly developed agricultural land.

The State of California, as part of its local assurance responsibilities, will be encouraged to arrange for disposal of quantities of sediment in excess of the 50,000 cubic yards to be removed annually for use as topsoil. Studies previously discussed have shown a potential for use of additional sediment over the 50-year project life. This practice of removing greater than 50,000 cubic yards annually would significantly prolong the life of the settling basin.



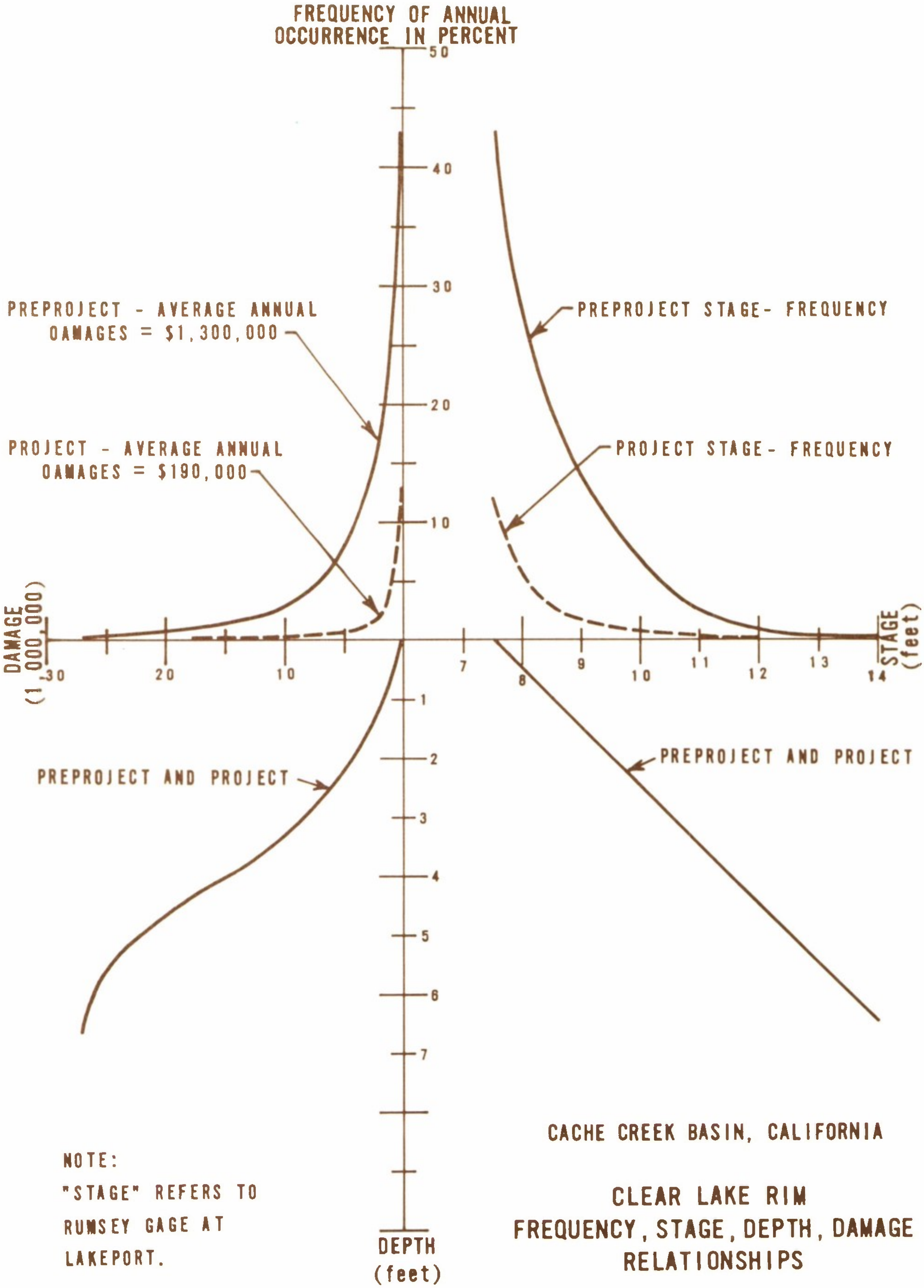
NOTES:

1. Existing capacity is 2500 c.f.s. at Clear Lake stage of 7.56 feet on Rumsey gage at Lakeport.
2. Economics based upon October 1977 price levels, 6-5/8% discount rate, 1985 project year, 100-year project life.

CACHE CREEK BASIN, CALIFORNIA

ENLARGE
OUTLET CHANNEL AND BYPASS
MAXIMIZATION OF NET BENEFITS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
AUGUST 1977



NOTE:
"STAGE" REFERS TO RUMSEY GAGE AT LAKEPORT.

CACHE CREEK BASIN, CALIFORNIA

CLEAR LAKE RIM
FREQUENCY, STAGE, DEPTH, DAMAGE RELATIONSHIPS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1977

LEGEND

Deposited sediment, acre-feet/year, pre-project conditions. — X

Deposited sediment, acre-feet/year, project conditions. — Y

Reduced sediment deposition, acre-feet/year, for which benefits are claimed. — Z

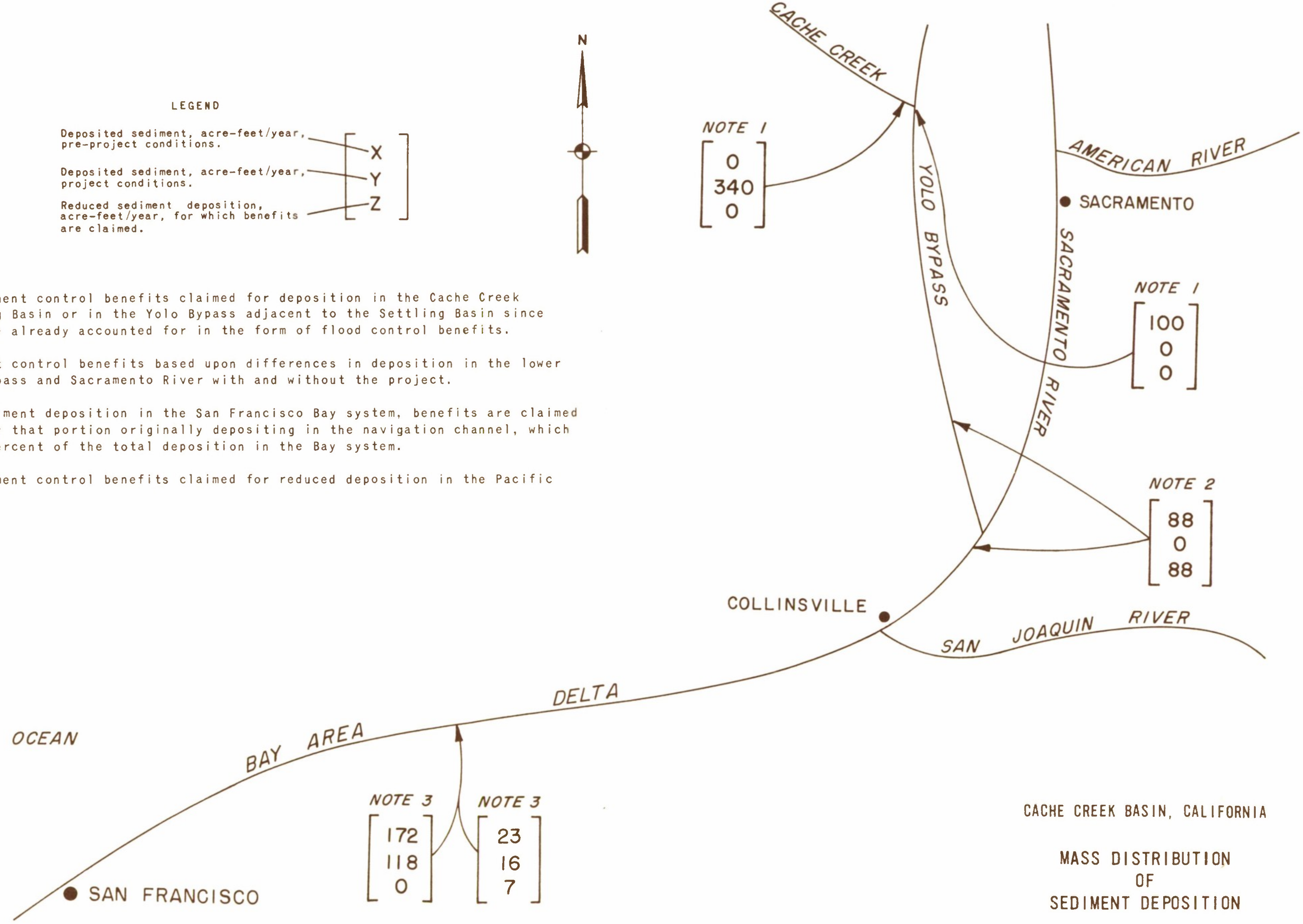
NOTES:

1. No sediment control benefits claimed for deposition in the Cache Creek Settling Basin or in the Yolo Bypass adjacent to the Settling Basin since they are already accounted for in the form of flood control benefits.

2. Sediment control benefits based upon differences in deposition in the lower Yolo Bypass and Sacramento River with and without the project.

3. For sediment deposition in the San Francisco Bay system, benefits are claimed for only that portion originally depositing in the navigation channel, which is 12 percent of the total deposition in the Bay system.

4. No sediment control benefits claimed for reduced deposition in the Pacific Ocean.



CACHE CREEK BASIN, CALIFORNIA

MASS DISTRIBUTION
OF
SEDIMENT DEPOSITION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
MAY 1979

SECTION G

DIVISION OF PLAN RESPONSIBILITIES

DIVISION OF PLAN RESPONSIBILITIES

TABLE OF CONTENTS

LIST OF TABLES

SECTION G

DIVISION OF PLAN RESPONSIBILITIES

1. Apportionment of costs between Federal and non-Federal interests in this section is based on traditional policies. The basis for apportioning costs for the project purposes is described in the paragraphs below.

Cost Apportionment

Upper Basin (Clear Lake)

2. Table G-1 shows the apportionment of the first and annual costs between Federal and non-Federal interests. Responsibilities of Federal and non-Federal interests are described in the following two paragraphs:

FEDERAL RESPONSIBILITIES

3. Sharing of costs between Federal and non-Federal interests for the flood control project is based upon the standard requirements established as Federal policy for "local protection" works. Under this policy, the Federal Government would be responsible for all construction costs. In addition, the Federal Government would design and prepare detailed plans and construct the project.

NON-FEDERAL RESPONSIBILITIES

4. Under the Federal policy requirements for "local protection" works, non-Federal interests would be required to furnish the following:

- Provide all lands, easements, and rights-of-way for construction and maintenance of the project, including all relocations and alterations of buildings, roads, highways and highway bridges, sewers, and utilities.

- Maintain and operate project facilities after completion of the project in accordance with regulations prescribed by the Secretary of the Army and perform anticipated replacements.

- Hold and save the United States free from damages due to the construction and operation of the project, except for damages due to the fault or negligence of the United States or its contractors.

- Adjust all claims regarding water rights that might be affected by the flood control improvements.

- Require future development on Clear Lake rim to build above or otherwise flood proof to the elevation specified under the National Flood Insurance Program. The specified elevation will be that in effect just prior to construction of the project.

Lower Basin (Cache Creek)

5. Table G-2 shows the apportionment of the first and annual costs between Federal and non-Federal interests. Responsibilities of Federal and non-Federal interests are described in the following two paragraphs:

FEDERAL RESPONSIBILITIES

6. Sharing of costs between Federal and non-Federal interests for the sediment control project is based on the requirements established as Federal policy for "local protection" works. Under this policy, the Federal Government would purchase in fee the entire 3,600-acre settling basin and would be reimbursed by local interests for those lands attributed to sediment control. Page E-22 of Appendix 1 contains a

discussion of this procedure. The Federal Government would also be responsible for all sediment control construction costs, design, preparation of detailed plans, and construction of the project.

7. Responsibility for construction, operation, and maintenance associated with the wildlife refuge would be similar to the requirements of Public Law 89-72, as amended. One hundred percent of the costs for lands, facilities, and construction, as well as all refuge operation and maintenance costs, will be a responsibility of the U.S. Fish and Wildlife Service.

NON-FEDERAL RESPONSIBILITIES

8. Under the Federal policy requirements for "local protection" works, non-Federal interests would be required to furnish the following:

- Provide all easements and rights-of-way for construction and maintenance of the sediment control project, including all relocations and alterations of buildings, roads, highways, sewers, and utilities, and reimburse the Federal Government for those lands attributed to sediment control.

- Maintain and operate sediment control facilities after completion of the project in accordance with requirements of the Secretary of the Army in a manner compatible with wildlife enhancement.

- Hold and save the United States free from damages due to the construction and operation of the sediment control project, except for damages due to the fault or negligence of the United States or its contractors.

- Adjust all claims regarding water rights that might be affected by the sediment control improvements.

- Over the 50-year project life, remove a quantity of sediment from the Cache Creek Settling Basin equivalent to at least 50,000 cubic yards per year.

TABLE G-1

COST APPORTIONMENT - UPPER BASIN

	FEDERAL Flood Control ($)	NON-FEDERAL Flood Control ($)
FIRST COSTS	3,740,000	2,310,000
ANNUAL COSTS		
Interest & Amortization	248,300	153,300
OM&R	0	11,400
TOTAL	248,300	164,700

TABLE G-2

COST APPORTIONMENT - LOWER BASIN

	FEDERAL		NON-FEDERAL	
	Flood Control	Wildlife Enhancement	Flood Control	Wildlife Enhancement
FIRST COSTS	10,020,000	1,410,000	480,000	0
Adjustment for excess Federal flood control costs (See *, p. F-5)	-1,800,000		+1,800,000	
Adjusted Subtotals	8,220,000	1,410,000	2,280,000	0
Adjusted Totals	9,630,000		2,280,000	
ANNUAL COSTS				
Interest and Amortization	665,000		157,400	
OM&R	125,000		19,100	
TOTAL (Combined)	790,000		176,500	

SECTION H

PROPOSED REVISED COST-SHARING RESPONSIBILITIES

PROPOSED REVISED
COST-SHARING RESPONSIBILITIES

TABLE OF CONTENTS

LIST OF TABLES

* * * *

SECTION H

PROPOSED REVISED COST-SHARING RESPONSIBILITIES

1. In his Environmental Message of 23 May 1977, the President directed the Office of Management and Budget, the Council on Environmental Quality, and the Water Resources Council". . . to conduct in consultation with the Congress and the public, a review of the present Federal water policy." In response to that directive, a policy review was undertaken, policy option papers were published in the Federal Register for public comment, and public hearings were held in nine cities throughout the Nation. During the policy review, one of the issues identified was inequitable sharing of costs of water resource projects. Subsequent to the policy review, the President made a decision regarding sharing of costs of Federal water projects to accomplish two important goals:

a. to involve States more heavily in water project decisions, and

b. to eliminate many of the conflicting rules governing cost-sharing for flood control projects - especially with regard to structural and nonstructural flood damage reduction measures.

This section presents revised cost-sharing responsibilities which reflect the President's recent decision.

The President's Proposed Policy

2. As applied to the Cache Creek project, the President's new cost-sharing policy requires the following:

- States will provide a legally binding commitment to contribute a 5 percent cash share of the total first cost of the project. The State's cash contribution is to be paid concurrently and proportionately with the Federal contractual obligation for project construction.

- Existing cost-sharing rules will be modified to require, in addition to the cost-sharing requirement discussed above, a 20 percent State contribution for flood damage reduction measures. This

contribution would include any combination of cash and in-kind contribution (land, easements, rights-of-way, etc.).

Cost Apportionment

3. Tables H-1 and H-2 show the apportionment of costs between Federal and non-Federal interests for the upper and lower Cache Creek Basin, respectively. Responsibilities of Federal and non-Federal interests are described in the paragraphs below. The California Reclamation Board furnished its intent to provide or cause others to provide the listed assurances by letter shown on page H-9.

FEDERAL RESPONSIBILITIES

4. Under the President's recent policy, sharing of costs between Federal and non-Federal interests is based upon standard requirements established as Federal policy for "local protection" works, except as noted under "Non-Federal Responsibilities" in paragraph 6. Should the cost of lands, easements, rights-of-way, and relocations exceed 20 percent of the cost of flood damage reduction measures, the Federal

Government shall reimburse local interests for all costs in excess of 20 percent. The Federal Government would also design, prepare detailed plans for, and construct the project.

5. Responsibility for construction, operation, and maintenance associated with the wildlife refuge would be similar to the requirements of Public Law 89-72, as amended. All of the costs for lands, facilities, and construction, as well as all refuge operation and maintenance costs, will be a responsibility of the Federal Government.

NON-FEDERAL RESPONSIBILITIES

6. Under the President's revised cost-sharing policy, non-Federal interests would be required to:

- Contribute a 5 percent cash share of the total first cost of the project, to be paid concurrently and proportionately with the Federal contractual obligation for project construction.

- Provide all lands, easements, and rights-of-way necessary for construction and maintenance of the project, including all relocations and alterations of buildings, roads, highways, bridges, sewers, and utilities.

- Pay or contribute in-kind that portion of the cost of flood damage reduction measures which, when added to the cost of lands, easements, rights-of-way, and relocations, would amount to 20 percent of the cost of flood damage reduction measures. Should the cost of lands, easements, rights-of-way, and relocations exceed 20 percent of the cost of flood damage reduction measures, the Federal Government shall reimburse local interests for all costs in excess of 20 percent.

- Maintain, operate, and replace project facilities after completion of the project in accordance with regulations prescribed by the Secretary of the Army, except for the wildlife refuge, and conduct sediment control operations in a manner compatible with wildlife enhancement.

- Hold and save the United States free from damages due to the construction and operation of the project, except for damages due to the fault or negligence of the United States or its contractors.

- Adjust all claims regarding water rights that might be affected by the project.

- Require future development on Clear Lake rim to build above or otherwise flood proof to the elevation specified under the National Flood Insurance Program. The specified elevation will be that in effect just prior to construction of the project.

- Over the 50-year project life of the Cache Creek Settling Basin, remove a quantity of sediment equivalent to at least 50,000 cubic yards per year.

TABLE H-1

COST APPORTIONMENT - UPPER BASIN

	FEDERAL Flood Control ($)	NON-FEDERAL Flood Control ($)
FIRST COSTS (Traditional Cost-sharing)	3,740,000	2,310,000
Adjustment for Federal reimbursement for costs in excess of 20 percent of flood damage reduction measures	+1,100,000	-1,100,000
Adjusted subtotals	4,840,000	1,210,000
Adjustment for 5 percent non-Federal share of total first cost	-302,000	+302,000
Adjusted totals	4,538,000	1,512,000
ANNUAL COSTS		
Interest and Amortization	301,300	100,300
OM&R	0	11,400
TOTAL	301,300	111,700

TABLE H-2

COST APPORTIONMENT - LOWER BASIN

	FEDERAL		NON-FEDERAL	
	Flood Control	Wildlife Enhancement	Flood Control	Wildlife Enhancement
FIRST COSTS (Traditional Cost-sharing)	10,020,000	1,410,000	480,000	0
Adjustment for excess Federal flood control costs	-1,800,000	-	+1,800,000	-
Adjusted subtotals	8,220,000	1,410,000	2,280,000	0
Adjustment for Federal reimbursement for costs in excess of 20 percent of flood damage reduction measures	+180,000	-	-180,000	-
Adjusted subtotals	8,400,000	1,410,000	2,100,000	0
Adjustment for 5 percent non-Federal share of total first cost	-525,000	-70,000	+525,000	+70,000
Adjusted totals	7,875,000	1,340,000	2,625,000	70,000
Adjusted totals	9,215,000		2,695,000	
ANNUAL COSTS				
Interest and Amortization	636,300		186,100	
OM&R	125,000		19,100	
TOTAL	761,300		205,200	

STATE OF CALIFORNIA—RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

DEPARTMENT OF WATER RESOURCES
THE RECLAMATION BOARD
1416 – 9th Street, Room 335-18
Sacramento, CA 95814
(916) 445-9454

JAN 2 - 1979

Colonel Donald M. O'Shei
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel O'Shei:

This letter is in response to a Corps request that the Reclamation Board provide assurances of local cooperation for the entire Cache Creek Project rather than just the Cache Creek Settling Basin portion. This request was prompted by the President's recent water policy message concerning proposed cost-sharing requirements.

We have reviewed both the upper portion of the project (Clear Lake Channel Enlargement and Bypass) and the lower portion of the project (Cache Creek Settling Basin Levees with Wildlife Refuge) and hereby express our support for the entire project. If the President's proposed cost-sharing criteria are implemented the Reclamation Board intends to provide or cause others to provide the necessary nonfederal requirements.

We point out that the Clear Lake Channel Enlargement and Bypass has never been authorized by the State Legislature. This authorization would need to be accomplished before formal State assurances could be given. The Board is prepared to support State authorization after federal authorization is attained. It should also be understood that in the case of both portions of the project, the State's share of funding must be provided by the Legislature. The Board is prepared to recommend budget requests for needed State funding at an appropriate future date.

Enclosed herewith is a certified copy of the Board's action authorizing me to furnish you this letter expressing the Board's intention to provide needed assurances on this project.

Sincerely,

for Gene Anderson
ELDON E. RINEHART
General Manager

Enclosure

EXTRACT FROM MINUTES OF MEETING OF
THE RECLAMATION BOARD
December 14, 1978

ITEM NO. 6 -

CACHE CREEK BASIN REPORT -

Discussion of the Cache Creek Basin Report and request authority for General Manager to send letter to Corps supporting the project.

Mr. George Spencer presented this matter to the Board and briefed the members on the Corps' Cache Creek Basin Investigation which was released in February, 1978. He said the Corps has looked at a number of alternatives and selected a plan for the Upper Basin and one for the Lower Basin.

. . .

A motion was made by Mrs. Magneson and seconded by Mr. DeWit to approve authorization to the General Manager to provide a letter to the Corps of Engineers expressing the Board's intention to provide or cause others to provide the necessary nonfederal requirements for the Corps' Cache Creek Basin Project. The upper project includes the modification of the Clear Lake Outlet and the lower project includes the modification of the Cache Creek Settling Basin.

. . .

The question was called for and unanimously carried.

STATE OF CALIFORNIA)
COUNTY OF SACRAMENTO) ss.
Office of The Reclamation Board)

I, TEDDY ALLEN, Assistant Secretary of The Reclamation Board, do hereby certify that the above is a true and correct extract from the Minutes of the meeting of said Board held on December 14, 1978.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of The Reclamation Board this 27th day of December, 1978.

Teddy Allen

TEDDY ALLEN, Assistant Secretary
The Reclamation Board

STATE OF CALIFORNIA—RESOURCES AGENCY
EDMUND G. BROWN JR., Governor

DEPARTMENT OF WATER RESOURCES
THE RECLAMATION BOARD
1416 - 9th Street, Room 335-18
Sacramento, CA 95814
(916) 445-9454

JUN 25 1979

Colonel Donald M. O'Shei
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel O'Shei:

Reference is made to your letter of 7 May 1979 requesting a restatement of assurance for the proposed Cache Creek Basin Investigation because of an increase in the estimated non-federal costs due to a revised interpretation of the President's new water policy. You also requested that The Reclamation Board reaffirm its authority to speak for the State.

At its regular meeting on June 8, 1979, The Reclamation Board authorized me to send this letter affirming the Board's continued support for the Cache Creek Basin Investigation. The estimated $230,000 increase in nonfederal costs due to a re-interpretation of President Carter's water policy does not change the Board's basic position in support of this project. The other statements in my letter of January 2, 1979 are a part of this reaffirmation of support.

We agree with your interpretation of the State Water Code and your conclusion that The Reclamation Board legally may speak for the State on this issue.

Sincerely,

Eldon E. Rinehart

ELDON E. RINEHART
General Manager

CACHE CREEK BASIN, CALIFORNIA

FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT
FOR WATER RESOURCES DEVELOPMENT

LAKE AND YOLO COUNTIES, CALIFORNIA

APPENDIX 2

Comments and Responses

PREPARED BY THE
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

This appendix contains all comments which were received specifically as a result of coordination of the draft feasibility report and environmental statement. Responses to comments received on the draft environmental statement are also included in this appendix. Responses to comments received on the draft feasibility report are included in that document.

COMMENTS AND RESPONSES

1. Many of the letters included in this appendix suggest revision or clarification of the draft environmental statement which accompanied and was bound with the draft feasibility report as Appendix 4. All comments received were reviewed and are generally of three types: (1) confusion because of adoption of a new report format, (2) lack of understanding about some project features, and (3) specific suggestions which were used to improve the draft environmental statement.

2. We have attempted to eliminate redundancy in the environmental statement, and this approach appears to have confused certain reviewers. In the past, when feasibility reports and environmental statements were bound and coordinated separately, considerable repetition occurred in the two documents, particularly in the descriptions of the present environment, project plan, and alternatives. In the new format used for the environmental statement, items discussed in detail in the feasibility report are briefly summarized in the environmental statement with the sections and pages of the feasibility report containing the detailed data parenthetically identified. This considerably reduced the volume of the impact statement and resulted in a concise analysis and evaluation of the significant impacts of the proposed plan and of the alternatives to the proposed plan.

3. In light of comments received, certain aspects of the proposed project deserve some reiteration or some amplification.

a. The project would not be growth inducing in the Clear Lake area because, as a local cooperation requirement, Lake County would be required to continue its current zoning restrictions on building nonfloodproofed structures below the present preproject 100-year flood plain elevation.

b. The project would not increase recreation use with accompanying adverse impact associated with algal bloom; the project provides for increased floodflow from Clear Lake and would reduce the level of flood stages (2.25 feet reduction for 100-year flood) and would not detrimentally affect nonflood period lake levels or accompanying recreation uses and algal bloom conditions.

c. Construction of the bypass channel would not split the outflow between the outlet channel and the bypass channel during low lake stages since there are no releases through Clear Lake Dam and thus there is no flow during those conditions. A backwater exists between Clear Lake and Clear Lake Dam at low lake stages, so the water elevation in the channels would be identical to the elevation of the lake.

d. Extensive analysis has shown that modified flows under project conditions would have an insignificant effect on existing erosion problems in and adjacent to Cache Creek downstream of Clear Lake Dam.

e. Other than those parties involved in the Gopcevic and Bemmerly Decrees, there are no known water diverters affected by the construction of the project; however, should any be affected, the local sponsor, rather than the United States, would be required to adjudicate all claims.

f. In the event that agreement on modification of the Gopcevic and Bemmerly Decrees cannot be reached, it would not be possible to enlarge the Clear Lake Outlet Channel.

g. Anderson Marsh was examined by a multi-agency State-Federal team utilizing the Fish and Wildlife Service's Habitat Evaluation Procedures, and that team determined that the proposed project would have no effect on the marsh.

h. The possibility was examined of controlling the source of sediment through modification of large land areas in the Capay Hills by means of planting, irrigation, and slope stabilization, but this method was determined to be economically infeasible and impractical because of the vast area requiring modification.

4. Those suggestions in the following table have been incorporated into the Feasibility Report or the revised draft environmental statement. In addition, if the project is authorized, all

environmental matters will be reexamined in greater detail in the advanced engineering and design studies which precede project construction.

5. A listing of letters received and copies of the letters may be found beginning on page 7.

Comment	Location of Modification	Agency/ Organization
Discuss seismic aspects of Cache Creek Basin	Appendix 1, page B-5 and RDEIS page 13	State of California
Discuss mineral deposits of Cache Creek Basin	Appendix 1, page B-5 and RDEIS pages 4 and 13	Bureau of Mines, State of California
Clarify habitat of bald eagle	Appendix 1, page B-12	Audubon Society
Discuss archeological resources of settling basin area	Appendix 1, page B-18	National Park Service
Ground water overdraft	Appendix 1, page C-54	Yolo County Flood Control and Water Conservation District
Discuss need to relocate sewers and storm drains	Appendix 1, page E-21, RDEIS page 2	City of Woodland
Discuss impact on Seigler Creek	Appendix 1, page E-11, RDEIS page 13	James Berwick
Discuss how increased flow will affect gravel operations	RDEIS page 13	State of California
Discuss maintenance aspects of reestablishing vegetation along channels	RDEIS page 14	State of California
Discuss stabilization of borrow material	RDEIS page 14	State of California
Discuss impact on aquatic productivity	RDEIS page 15	Fish and Wildlife Service
Solicit input from Native American community	RDEIS page 16	National Park Service
Include discussion of items eligible for the National Register of Historic Places	RDEIS page 16	National Park Service

Comment	Location of Modification	Agency/ Organization
Discuss saleability of topsoil	RDEIS page 18	City of Woodland
Discuss effect of reducing flood frequency on wildlife habitat	RDEIS page 29	Fish and Wildlife Service
Discuss long-term impact of fish and wildlife resources	RDEIS page 29	Fish and Wildlife Service
Discuss sediment studies under Section 208 of Public Law 92-500	Appendix 1, Page D-14	State of California and Yolo County Resource Conservation District
Discuss how sediment will be disposed of and availability of a local market	Appendix 1, Page E-18	City of Woodland
Discuss increased annual operating costs for City of Woodland storm drains	Appendix 1, Page E-23	City of Woodland
Show compliance with Section 106 of National Historic Preservation Act	RDEIS, page 16	Advisory Council on Historic Preservation

COMMENTS AND RESPONSES

COMMENTS AND RESPONSES (Cont'd)

OFFICE OF THE SECRETARY
RESOURCES BUILDING
1416 NINTH STREET
95814

(916) 445-5656

Department of Conservation
Department of Fish and Game
Department of Forestry
Department of Navigation and Ocean Development
Department of Parks and Recreation
Department of Water Resources

EDMUND G. BROWN JR.
GOVERNOR OF
CALIFORNIA

Air Resources Board
California Coastal Commission
California Conservation Corps
Colorado River Board
Energy Resources Conservation and Development Commission
Regional Water Quality Control Boards
San Francisco Bay Conservation and Development Commission
Solid Waste Management Board
State Coastal Conservancy
State Lands Commission
State Reclamation Board
State Water Resources Control Board

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

MAY 25 1978

Colonel Donald M. O'Shei
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel O'Shei:

The Draft Feasibility Report and Environmental Statement for Water Resources Development for the Cache Creek Basin in Lake and Yolo Counties which you submitted to the Office of Planning and Research (State Clearinghouse) has been reviewed by the State agencies concerned. This review fulfills requirements under Part II of the U. S. Office of Management and Budget Circular A-95 and the National Environmental Policy Act of 1969.

The report has been reviewed by the Departments of Conservation, Fish and Game, Parks and Recreation, Navigation and Ocean Development, Water Resources, Food and Agriculture, General Services, Health, and Transportation; the Air Resources, Solid Waste Management, and State Water Resources Control Boards; and the Energy Resources Conservation and Development, Public Utilities, and State Lands Commissions.

The report studies flooding along the Clear Lake shoreline and makes recommendations to reduce it by enlarging portions of the lake's 8-kilometre (5-mile) outlet channel and by building a bypass to help relieve high flows in the channel where enlargement is unfeasible. Also included in the report are recommendations to enlarge and raise existing levees of the 1 500-hectare (3,600-acre) Cache Creek Settling Basin and establish a National Wildlife Refuge.

Recommendations

1. Measures should be proposed for stabilizing borrow and excavated material spread adjacent to the channel in the upper Cache Creek Basin to preclude the material's entry into the stream.

2. The environmental statement should discuss the impacts on water quality and on the settling basins caused by increasing the outlet channel capacity and the resultant potential for increased bank erosion between Clear Lake Dam and the Cache Creek Settling Basin.

3. The environmental statement should discuss the necessity of court modification of the Gopcevic and Bemmerly Decrees as they relate to altering the Clear Lake outlet channel. If the Gopcevic Decree must be changed, as stated by the report, it should only be changed to allow modification of the outlet channel. Operating limits for Clear Lake as specified in the decree should not be modified in any way that would lower water surface levels in the lake.

4. The environmental statement indicates that existing water rights on Clear Lake and Cache Creek could be affected by flood control facilities (pages 64 and 65). The final document should identify the specific water diverters affected and the way in which diversions will be altered.

5. Controlling sediment sources within the lower Cache Creek Basin should be considered as an alternative to using the settling basin for sediment control. This alternative should include:

   a. Measures which could be taken to stabilize the channel and its tributaries and to reduce erosion from tributary lands. Studies presently being carried out under Section 208 of the Federal Water Pollution Control Act are addressing these problems, particularly with respect to land erosion.

   b. The effects of commercial gravel removal from the Cache Creek channel on accelerated channel erosion should be considered in terms of its effect on surface water quality and the life of the settling basin.

   c. The effects of gravel removal and accelerated erosion should be considered with respect to ground water quality and ground water recharge in the Cache Creek Basin.

   d. A benefit/cost study of water quality protection by source control measures should be completed for comparison with the benefits and costs of the proposed project. The study should analyze all related problems, such as erosion, gravel removal, streambed sediment loads, ground water recharge, and settling basin capacity.

6. Clear Lake marshlands, Anderson Marsh in particular, are identified as critical habitat for the fish and wildlife resources of the lake. The report should include additional detail on marsh elevations, elevations of surrounding riparian lands, extent of flooding at various water levels up to at least the 9-foot mark on the Rumsey Gauge, and the effect of the project on the extent of flooding. While it is known that the marshes are inundated at 7.56 feet on the Rumsey Gauge, data are needed on water levels needed by the marsh and surrounding riparian lands for optimum production.

7. The proposed operation of the Clear Lake flood control system is not discussed. Use of the system operating curves to control lake levels and prevent flooding in lower Cache Creek was explained at the public meetings of March 20 and 21, 1978. This information should also be included in the report.

8. The report stated that the establishment of riparian vegetation along the bypass channel and along the enlarged portions of the natural channel could be dependent on maintenance frequency. The report should discuss predicted maintenance frequency, type of maintenance expected, and its potential effect on riparian vegetation.

General Comments

The Department finds the proposed project economically justified and eligible for State participation in the non-federal capital costs, providing the project is authorized by Congress and the State Legislature and complies with the requirements of the Cobey-Alquist Flood Plain Management Act. State financial participation is limited to a portion of the costs of rights-of-way and relocations which are required for construction of the flood control features and 50 percent of the non-federal capital costs of any recreation and fish and wildlife enhancement features of the project.

Please be advised that the California State Lands Commission claims ownership to the bed of Cache Creek below the ordinary high water mark. The State Lands Commission also claims ownership to the area known as Anderson Marsh at Clear Lake lying adjacent to Cache Creek. The issue of the State's claim of ownership to both of these areas is presently the subject of litigation in the case of Lyon v. State, Lake County Superior Court Case No. 13925. Chapter 639 of the Statutes of 1973 granted the State's interest in the bed of Clear Lake to the County of Lake. Any authority in the area of Clear Lake and Cache Creek will require all necessary permits and lease from both the State Lands Commission and the County of Lake.

Specific Comments

With regard to the upper basin (Clear Lake), the State supports the need to modify the Clear Lake outlet and favors the alternative chosen by the Corps. This alternative, which includes a bypass channel, provides the needed flood protection around the lake with minimum adverse environmental impacts and maximum cost effectiveness.

The final report should note potential benefit to the Yolo County Flood Control and Water Conservation District from the Clear Lake outlet enlargement. The added flexibility of operation provided by the larger outlet would permit spring water levels to be held higher while maintaining flood protection. This allows the greatest possible storage for the opening of the irrigation season and will help to promote a sufficiency of irrigation water without dropping lake levels below the legal limit in the fall.

With regard to the lower basin, the State favors raising the settling basin levees, rebuilding the cobble weir, and developing a waterfowl refuge. The existing settling basin is almost filled, and raising its levees would prolong its usefulness while providing environmental enhancement in the form of a waterfowl refuge.

One area of concern to the State which needs to be worked out in more detail is the removal of future sediment buildup in the Cache Creek Settling Basin. The report anticipates that a market exists for 38 000 cubic metres (50,000 cubic yards) of sediment annually for use by local topsoil distributors. We would like to see this and other alternatives for sediment removal discussed more fully in the final report. In particular, the final report should note that sediment removed from the basin would become the property of the State for sale as topsoil or for other uses.

In several places in the report, there is discussion of sand and gravel operations along the lower reaches of Cache Creek. There is no general discussion, however, of the presence or absence of mineral resources along the creek, especially in the outlet channel area or the settling basin area. Deposits of natural gas, for example, may underlie the settling basin.

In regard to existing gravel operations, it is stated on page 12 of Appendix 4 that these operations have widened the channel downstream from Capay, thus any increased flows will have negligible effect on the creek because of this larger channel capacity. A discussion should be included concerning how this increased flow will affect the gravel operations.

It is stated on page 12 of Appendix 4 that the "only project feature which could be affected by seismic activities would be the Cache Creek Settling Basin, and no active faults have been found in this area." This statement omits tha possibility that the proposad channel control

etructure weir and bypass channel weir, along the channel outlet at Clear Lake, could be effected by seismic activity; this possibility should be discussed in the report. Furthermore, although no active feults were identified in the settling bssin, this does not preclude potentially detrimental effects on the levees and Cobble Weir that might be ceused by earthquake ehaking end possible associated ground failure. Proposed design end construction measures to mitigate these problems, for etructures in both the basin and et the Clear Lake outlet, should be diecuseed.

Thank you for the opportunity to review this material.

Sincerely,

L. FRANK GOODSON
Assistant Secretary for Resources

cc: Director of Management Syetems
Stete Clearinghouse
Office of Planning and Research
1400 Tenth Street
Secramento, CA 95814
(SCH No. 78030647)

STATE OF CALIFORNIA—RESOURCES AGENCY — EDMUND G. BROWN JR., Governor

DEPARTMENT OF WATER RESOURCES
THE RECLAMATION BOARD
1416 - 9th Street, Room 335-18
Sacramento, CA 95814
916 445-9454

July 19, 1978

District Engineer
Sacramento District
U. S. Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Sir:

Reference is made to the Cache Creek Settling Basin Project on Cache Creek near Woodland, California, and to your telephone request of July 17, 1978, requesting that the State Reclamation Board furnish you the assurances of local cooperation as required by Federal law.

This will inform you that The Reclamation Board, at its meeting of July 18, 1978, authorized the Acting General Manager to furnish you with the required assurances for the project. The Reclamation Board, for the State of California, under the authority granted it under Chapter 1438 of the Statutes of 1963, hereby furnishes the following assurances to you with respect to the Cache Creek Settling Basin Project:

The Board will:

a. Provide all easements and rights of way for construction and maintenance of the sediment control project, including all relocations and alterations of buildings, roads, highways, sewers and utilities and reimburse the Federal Government for those lands attributed to sediment control, now estimated at $1.8 million;

b. Maintain and operate sediment control facilities after completion of the project in accordance with requirements prescribed by the Secretary of the Army in a manner compatible with wildlife enhancement and management;

c. Hold and save the United States free from damages due to the construction and operation of the sediment control project, except for damages due to the fault or negligence of the United States or its contractors;

d. Adjust all claims regarding water rights that might be affected by the sediment control improvements;

e. Over the 50-year project life, remove a quantity of sediment from the Cache Creek Settling Basin equivalent to at least 50,000 cubic yards per year.

Enclosed herewith you will find a certified copy of the Board's resolution authorizing the Board's Acting General Manager to furnish you the required assurances.

Sincerely,

John F. Wright
JOHN F. WRIGHT
Chief Engineer and
Acting General Manager

Encl

EXTRACT FROM MINUTES OF MEETING OF
THE RECLAMATION BOARD
July 18, 1978

- - - - - - -

GENERAL - Off Calendar

Request authority for Acting General Manager to give the Corps of Engineers the necessary assurances on the Cache Creek Settling Basin Project.

Mr. John Wright presented the above request to the Board.

Upon motion by Mr. Hamatani, seconded by Mrs. Magneson and unanimously carried, authority was given for Board's Acting General Manager to give the Corps of Engineers the necessary assurances on the Cache Creek Settling Basin Project.

STATE OF CALIFORNIA)
COUNTY OF SACRAMENTO) ss.
Office of The Reclamation Board)

I, TEDDY ALLEN, Assistant Secretary of The Reclamation Board, do hereby certify that the above is a true and correct extract from the Minutes of the meeting of said Board held on July 18, 1978.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of The Reclamation Board this 19th day of July, 1978.

Teddy Allen

TEDDY ALLEN
Assistant Secretary
The Reclamation Board

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY — EDMUND G. BROWN JR., Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 01, P. O. BOX 3700
EUREKA, CALIFORNIA 95501
(707) 442-5761

March 17, 1978

01-Lak-53-1±

U. S. Army Corps of Engineers
Sacramento District
640 Capitol Mall
Sacramento, CA 95814

Attention Investigations Section A

Gentlemen:

We wish to have the following information included in the hearing record for the proposed Cache Creek Basin investigation.

On Page 48 of the Feasibility Report for the Cache Creek Basin, it is indicated that items which include relocation of bridges is the responsibility of the local interests. Since the proposed bypass channel for Cache Creek will require construction of a new bridge on Route 53, Caltrans wishes to make it clear that these costs are to be borne by others and not by Caltrans. Any environmental clearances necessary for the construction of a new bridge on Route 53 should be accomplished either by the Corps or by the local interests.

We appreciate the opportunity to comment on the Draft Feasibility Report for the Cache Creek Basin.

Sincerely,

W Z Hegy

W. Z. Hegy
District Director

Yolo County Resource Conservation District

Box 135 ZAMORA, CALIFORNIA 95698 PHONE (916) 662-2561 / 2037

March 23, 1978

Directors

[illegible]

Kenneth Haussler
Rt. 1, Box 1540
Davis, CA 95616

Frank Sieferman
Box 135
Zamora, CA 95698

Robert Moeller
Rt. 1, Box 136
Woodland, CA 95695

Joseph Fernham
Rt. 3, Box 614
Woodland, CA 95695

U. S. Army Corps of Engineers
Sacramento District
ATTENTION: Investigations Section A
650 Capitol Mall
Sacramento, California 95814

Re: Cache Creek Inv.

Gentlemen:

Yolo County Resource Conservation District submits the following statement:

The report does not attempt to retain the sediment at its source or to protect or atabilize stream bank erosion and only addresses itself to the containment of sediment within the settling basin and periodically removal of the excess.

In our opinion this proposed project is in conflict with the Purpose of PL 92-500 Sect. 208 (Clean Water Act of 1977).

Very truly yours,

Frank Sieferman

Frank Sieferman,
Secretary

CONSERVATION · DEVELOPMENT · SELF-GOVERNMENT

LAKE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

255 NORTH FORBES STREET, LAKEPORT, CALIFORNIA 95453
TELEPHONE 707/263-2343

H. C. "Hank" PORTER, Acting Manager

June 13, 1978

U. S. Army Corps of Engineers
650 Capitol Mall Room 6560
Sacramento, California 95814

Attention: Mr. John P. Saia, Chief Investigation Section A

Subject: Resolution supporting Cache Creek Channel Project

Gentlemen:

Enclosed please find the Resolution passed by our Board of Supervisors yesterday in support of authorization and early construction of the Cache Creek Basin flood control project proposed by the Corps of Engineers.

Very truly yours,

H. C. Porter
Acting Manager

HCP:ps
encs.

cc: County Clerk

BOARD OF SUPERVISORS, COUNTY OF LAKE

STATE OF CALIFORNIA

RESOLUTION NO. 78-173

RESOLUTION SUPPORTING THE AUTHORIZATION AND EARLY CONSTRUCTION OF A FLOOD CONTROL PROJECT PROPOSED BY THE U. S. ARMY ENGINEER DISTRICT, SACRAMENTO, CORPS OF ENGINEERS, IN ITS CACHE CREEK BASIN, CALIFORNIA FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT FOR WATER RESOURCES DEVELOPMENT DATED FEBRUARY 1978

WHEREAS, a serious flood problem exists within Lake County which requires corrective measures at an early date; and

WHEREAS, the Corps of Engineers has proposed a plan consisting of widening and deepening 3.3 miles of the existing Clear Lake Outlet Channel, constructing a 1.1-mile-long bypass channel around the highly developed portion of the existing channel, constructing a diversion control structure and weir at the upstream end of the bypass channel, and requiring future development to flood proof or otherwise construct above the elevation of the preproject 100-year flood plain; and

WHEREAS, the plan would substantially reduce flood damages to development along the lake rim and outlet channel; and

WHEREAS, the State of California has indicated that it finds the proposed project economically justified and eligible for State participation in the non-Federal capital costs, State financial participation being limited to a portion of the costs of rights-of-way and relocations which are required for construction of the flood control features.

NOW, THEREFORE, BE IT RESOLVED that the County of Lake, State of California, strongly supports authorization and early construction of the flood control project proposed by the Corps of Engineers for Cache Creek Basin (Clear Lake); and

BE IT FURTHER RESOLVED that the Board understands that should the project be authorized by Congress and approved by the Lake County voters, it will and intends to comply with the following requirements of local cooperation:

a) Provide all lands, easements, and rights-of-way for construction and maintenance of the project, including all relocations and alterations of buildings, roads, highways and highway bridges, sewers, and utilities.

b) Maintain, operate, and replace project facilities after completion

-1-

of the project in accordance with regulations prescribed by the Secretary of the Army.

c) Prescribe and enforce regulations to prevent obstruction of encroachment upon the project channels that would reduce their flood carrying capacity or hinder maintenance and operation.

d) Hold and save the United States free from damages due to the construction and operation of the project, except for damages due to the fault or negligence of the United States or its contractors.

e) Adjust all claims regarding water rights that might be affected by the flood control improvements.

f) Require future development on Clear Lake rim to build above or otherwise flood proof to the elevation specified under the National Flood Insurance Program. The specific elevation will be that in effect just prior to construction of the project.

This Resolution was passed by the Board of Supervisors of the County of Lake at a regular meeting thereof held on June 12, 1973, by the following votes:

AYES: Supervisors Burry, Lovi, Mostin, Jones

NOES: None

ABSENT OR NOT VOTING: Supervisor Gordon

Robert M. Jones

Robert M. Jones, Chairman
BOARD OF SUPERVISORS
COUNTY OF LAKE

ATTEST: LOIS R. HESTERBERG, COUNTY CLERK

BY: ______ Deputy

APPROVED AS TO FORM: CHARLES D. HAUGHTON
COUNTY COUNSEL

Charles D. Haughton

Yolo County Flood Control & Water Conservation District

P.O. BOX 767
WOODLAND, CALIFORNIA 95695

Please address the district and refer to

WM. L. McANLIS
Manager

427 Cleveland St., Woodland
Telephone 662-0265

March 20, 1978

Mr. Donald M. O'Shei
Colonel, CE
District Engineer
Corp of Engineers
650 Capitol Mall
Sacramento, California 95814

Subject: Draft Feasibility Report and
Environmental Statement
Cache Creek Basin Investigation
Lake & Yolo Counties, California

Statement of Yolo County Flood Control
and Water Conservation District

Dear Colonel O'Shei:

Please include the following comments on the draft feasibility report and EIS for the Cache Creek Basin Investigation in your final report on this project.

First of all, we commend you and your staff for an excellent analysis of flood, sediment, and related water resource problems of the Cache Creek Basin. We do not disagree with either of the final choices of alternatives with respect to Clear Lake Basin flooding and lower basin sediment control.

When your initial information was presented on the project in November and December of 1975, the litigation with respect to our district's operation of storage on Clear Lake was still unresolved as between Lake County and our District. I'm happy to inform you that a stipulated judgement has been entered in the Solano County Superior Court earlier this month. However, the major questions of modification of the Gopcevic and Bemmerly Decrees still remain to be resolved.

This statement will be kept to the broad issues. A separate statement to follow in several weeks will deal with the smaller details.

First of all, we note that, although the project report on the Clear Lake flooding problem mentions the structural measures necessary to improve channel capacity over what now exists at the Grigsby riffle in the Clear Lake outlet channel, only brief and cursory statements are included in the report referring to the operation of the Clear Lake Dam hy our District. It would seem appropriate to expand at some length in your final report on the function of that dam as, in reality, the actual flood control structure of the project. Stating the matter simply, all of the channel enlargement in the world will not result in any flood control operation--only the District's operation of the Clear Lake Dam facility, coupled with adequate channel capacity, can adequately achieve the results sought. Among other elements which occur to us as being involved in operation of the Clear Lake Dam for flood control are:

1. Adequate provision for debris control and collection upstream of the dam or by adequate trash racks and cleaning capacity at the dam in order to prevent plugging of the submerged gate openings at the new high levels of release contemplated by the project.

2. Erosion control for and protection and improvement of the existing access road along the north side of the channel leading to the dam because of the higher flows contemplated under project operation.

3. Rehabilitation and perhaps major modification of this 60-year-old structure to permit its safe and efficient operation for flood control purposes in the manner desired, as opposed to the present operation which simply requires occasional adjustments in outflow to pass the limited flows in the channel.

4. An estimate of reasonable additional costs to be imposed by reason of the flood control operation of Clear Lake Dam and the proper allocation of those costs.

Secondly, we have major concerns as to the impact of the generally higher level of releases in the Cache Creek channel in Yolo County. For example, Page C-41 of Appendix 1 indicates that approximately 90 percent of the average annual bed material transport occurs during flows between 1,500 and 11,000 CFS. Also, values derived from your Table C-21 on that same page confirm our own informal conclusions that, for the reach between Capay and Yolo, the most active bed material movement per CFS occurs in the range of flows between 3,000 and 15,000, with the maximum carriage per CFS apparently coming at about 6,000 to 7,000 CFS discharge.

On balance, these changes in the regime of the stream may be more favorable than unfavorable, as it should be apparent that the major contributions to the stream bed load and wash load coming from the Capay Valley area will be essentially the same whether or not the project is in existence. Some augmentation of flows in the creek may actually be desireable in moving that sediment inflow from the Capay Valley hills to downstream areas. Nevertheless, a great deal more work appears to be desirable in order to provide a clear picture of the impacts, both adverse and favorable, that increased Cache Creek flows will have on the lower basin.

The above comments have bearing particularly in considering the necessity of concurrence by many Yolo County interests and agencies in the modification of both the Gopcevic and Bemmerly Decrees. It should be quite clear that no modification of these decrees can be expected unless and until the Corps and the project sponsors can, with some finality, assure both the downstream landowners adjacent to Cache Creek and the Courts that the position of the parties will not be made worse by the total project than it would have been at the time the decrees were entered.

One last general comment which has perhaps some bearing on the formulation of the project plan would be to observe that the ground water overdraft estimate cited in several parts of the report and the appendices as "between 60,000 and 80,000 acre feet per year" is based on a rather old report prepared for our District prior to Indian Valley Dam and Reservoir. In essence, our latest investigations and those only recently completed by Clendenen and Associates, consultants to Yolo County, indicate that water requirements and supply are relatively close to balance at this time. We anticipate further water requirements in the years ahead and are pursuing the acquisition of Tehema-Colusa Canal water by contract with the Bureau of Reclamation to meet these anticipated needs. In any event, conjunctive operation of our surface and ground water supplies should keep the ground water supply in balance generally with the average safe annual yield.

We appreciate the opportunity to provide these comments at this time and will be furnishing you in the next few weeks with detailed and specific comments relating to the project.

Sincerely yours,

L. H. Barth

L. H. Barth, Chairman
Board of Directors,
Yolo County Flood Control &
Water Conservation District

DAVIS AUDUBON SOCIETY INC

April 5, 1978

Colonel Donald M. O'Shei
Department of the Army
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Colonel O'Shei;

On behalf of the Davis Audubon Society, I would like to thank you for the opportunity to comment on the Cache Creek Basin draft feasibility report and environmental statement. Our president, Anne Sands, and I have reviewed the report in detail. The following paragraphs outline our comments and concerns.

A correction should be made regarding the Southern Bald Eagle's use of the area. Appendix 1 B-13, lines 4 and 5 imply that these birds are found only in open grasslands. This paragraph should be amended to include the Bald Eagle's use of riparian forests as resting perches and as potential nest sites. While Bald Eagles may not be present at this time within the project area, it is important to recognize the significance of riparian forests, if these birds ever do recover sufficiently to restablish themselves in the area.

Clear Lake Outlet Channel Enlargement and Bypass.
We were generally satisfied with the features of this plan. In particular, we wish to stress the importance of requiring that future development on Clear Lake rim be above the 11.85-foot elevation. We feel that this type of flood-proofing is an effective way to discourage building in flood prone areas. Raising the 100-year flood plain would eliminate the need for further flood control projects, such as this one, which expend large sums of money and utilize precious energy.

Plan 9 has the potential to generate significant benefits to wildlife. The planting of riparian vegetation along the existing channel, and the creation of new riparian vegetation along the bypass channel are attractive features of this plan. Davis Audubon Society would be happy to assist you in selecting appropriate species for the planting.

We are pleased to learn of California Department of Fish and Game plans to purchase Anderson Marsh, an important habitat which should be preserved in its natural state.

PO Box 886 Davis California 95616

Raise Settling Basin Levees with Wildlife Refuge.
We found this plan to be the most satisfactory of the alternatives considered. The wildlife refuge will serve as valuable additional habitat for both migratory and resident birds. Hopefully, the disturbance created by sediment excavation will be kept to a minimum; it should be carried out during a season when it will not have an impact on nesting activities of the birds on the refuge.

The wildlife refuge could certainly provide an excellent environmental education facility; its proximity to Davis and Woodland would undoubtably be well received by local teachers.

The Davis Audubon Society would like to be informed of any future meetings concerning this project. If our society can be of further assistance to you, please contact me at the Davis Audubon Society PO Box. Thank you for your consideration.

Sincerely,

Katherine Balderston

Katherine Balderston
Conservation Chairwoman

cc: Mr. Richard Martyr
Western Regional Representative
National Audubon Society

Mr. George Weddell
Army Corps of Engineers

Senator John Dunlap
District 4
California State Senate

City of Woodland

CITY HALL WOODLAND, CALIFORNIA 95695 (916) 662-5416

PUBLIC WORKS DEPARTMENT

March 27, 1978

Department of the Army
Sacramento District
Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

ATTN: Mr. Donald M. O'Shei
Colonel, C.E.
District Engineer

RE: Cache Creek Settling Basin EIS

Gentlemen:

The City of Woodland wishes to take this opportunity to respond to the Draft Feasibility Report And EIS For The Cache Creek Settling Basin Investigation in Yolo County. Our comments are as follows:

1. We do not believe that the potential of removal of 50,000 cu. ft. of sediment annually from the basin by local top soil merchants is realistic. There is no local market for top soil. Spreckels Sugar Company has a mountain of tare dirt washed from sugar beets that they are unable to dispose of. The City of Woodland constantly gets requests from residents wanting to dispose of excess soil from construction of swimming pools, etc.

   The City of Woodland traded soil for the excavation of sewage treatment ponds to contractors that constructed I5 freeway. We were unable to get $.05 per cubic yard. Owners of the land in the Cache Creek Settling Basin were unable to get $.15 per cubic yard.

   The only top soil sold locally is from gravel companies and this is exceedingly small.

2. The report fails to recognize the existence of several City facilities e.g.; a 24" dia. outfall sanitary sewer that completely traverses the Cache Creek Settling Basin which in all probability will not be able to support the proposed

depth of fill; a 30" dia. sanitary sewer which runs along the old alignment of County Road 103; a gravity 36" dia. storm sewer line which discharges by gravity into the southwest corner of the basin; a 50 HP pumping plant south of the River Road at County Road 103 that discharges into the basin; no comment is made of the 48" dia. gravity drain that is at the southwest corner of the basin.

3. No mention is made of the increased annual operating costs to the City because of increased pumping head and the loss of the gravity drain features for storm drainage.

4. No mention is made of the economic impact to Yolo County for the loss of 3,600 acres of land from the tax rolls and also any special districts involved.

5. Appendix 1-C-24 incorrectly states that some of the City of Woodland is infrequently flooded from Cache Creek.

6. Table C-10, Cache Creek Damageable Property Values in 1977, does not correlate with the flood insurance map prepared by the Corps for the City of Woodland.

7. Appendix 1-C-38 omits County Road 102 bridge, I5 bridge, SPRR bridge and SR113 bridge.

8. Various plates refer to the SNRR as the SPRR.

9. Appendix 1-C-55, 92., makes reference to the Clear Lake Water Company - this no longer exists.

10. No mention is made of the 500 KVA Northwest Intertie electrical transmission line that traverses the basin - essential cable clearance may be jeopardized.

The City of Woodland generally concurs with the concept but sees the construction costs and operating costs as understated.

Thank you for the opportunity to comment.

Yours truly,

A. L. Hiatt

A. L. Hiatt
City Engineer

ALH/rv

Clear Lake Water District

POST OFFICE BOX ? ?
LOWER LAKE, LAKE COUNTY, CALIFORNIA
95457

March 29, 1978

Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Att. Mark Capik

Re: Cache Creek Flood Control Project

Dear Mr. Capik:

We write as the Board of Directors of the Clear Lake Water District to express the viewpoint of the District in regard to the Corps' current plans for flood control on Clear Lake and along Cache Creek.

The Clear Lake Water District is a legal entity, duly formed under the California Water Code, and includes within its boundaries approximately twenty miles of shoreline on Clear Lake and along its outlet, Cache Creek. Its Board of Directors represents the approximately six thousand land owners within its borders, living in residential communities and recreational developments along the southern shores of Clear Lake and along Cache Creek.

As to the various plans for flood control being considered by the Corps, the consensus opinion within the District seems to be very definitely in favor of a widening and deepening of the existing channel. We hear no arguments in favor of a bypass, though we do hear many arguments against such a second channel.

Those who own homes and resorts along Cache Creek see a bypass as a threat to the uses they have planned for their property and as an unnecessary disruption of their present developments and life-styles. They realize that the scanty waters of the main channel would have to be shared with any bypass constructed; they therefore foresee that during dry years they would have two channels of unsightly, mosquito-breeding mudholes instead of the one they already have during the fall and late summer. They realize that the weirs to the present channel would be a restrictive annoyance, and that somehow, they would be expected to pay a share of the cost for extensive land purchases and two new bridges, and for weirs which would have to be operated and maintained at great expense. They cannot believe that all this complication should be necessary to gain effective flood control.

On the other hand, those who live and work along the Creek, as well as those who live throughout Lake County, have long looked forward to an improvement of the present channel — a project which would not only provide the necessary flood relief in both areas, but which would also result in an all-year channel from the Lake to the Dam. At present, boating and other water-based recreation can be enjoyed along Cache Creek during the early months of the year only. Rocky obstructions and shallow spots preclude ordinary access to, and extensive use of, what could, with proper enlargement, become a scenic, year-round waterway of exceptional recreation and aesthetic value.

We members of the Board of Directors of the Clear Lake Water District reflect the attitude of the landowners within the District, therefore, when we urge the Corps to adopt the "Alternative 2" plan for its flood control project in the area. (We refer, of course, to the plan discussed on Page 10 and the facing fold-out in your Information Brochure, Cache Creek Basin Investigation of November, 1975.)

We have given the matter serious study and practical consideration, together with on-the-site inspection, and are firmly convinced that the "Alternative 2" would not only accomplish the desired results, but would do so with a minimum of disruption to the area and cost to the County for maintenance. It seems to us the most feasible and practical of the plans presented and would bring to Cache Creek a very desirable bonus in the form of a year-round channel....The Clear Lake Water District urges the adoption of the "Alternative 2" plan for flood control on Clear Lake and Cache Creek. Thank you for your consideration of this viewpoint.

Yours truly,

John L. Jago
John L. Jago, President of the Board of Directors

John T. Anderson
John T. Anderson, Director

George L. McLeod
George McLeod, Director

Arthur Zilke
Arthur Zilke, Director

Clear Lake Water Quality Council, Inc.

FOUNDED IN 1970

P. O. BOX 1448 PHONE (707) 263-~~3193~~ 6131

LAKEPORT, CALIFORNIA 95453

April 6, 1978

Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 98514

Attention: Mark Capik

Re: Cache Creek Flood Control Project

Dear Mr. Capik:

The Board of Directors of the Clear Lake Water Quality Council, representing over 1,000 members, writes to express its viewpoint on the proposed Cache Creek Flood Control Project. It is overwhelmingly in favor of "Alternative 2" (Modified Plan 8) - the plan for deepening and widening the present channel as a means to effective flood control on Clear Lake.

The Board has heard no favorable comment <u>for</u> the bypass plan. The principal arguments one hears <u>against</u> it are the obvious ones:

1. Disruption of present and future use of the property involved.

2. The prospect of considerable maintenance and operation costs of the complicated facilities necessitated by the bypass.

3. The adverse effects of dividing up an already scanty creek flow for the sake of keeping a second channel alive.

A principal argument in favor of the enlargement of the present channel is, of course, the great advantage of having a scenic and useful stream all the way from the Lake to the Dam. This has been a prospect long hoped for by Clear Lake and Creek residents.

The Council is in harmony with the Lake County Board of Supervisors as to the use of the present channel for flood control (See their letter of April 3) but differs with the Supervisors when they suggest that less than a full degree of flood control would probably suffice. As the Council sees it, "partial control" could, under many circumstances, be little better than "no control", and yet would cost very little less than "optimum control". If the latter is not economically feasible, then that is a financial fact to be faced realistically; but the Council would be opposed to what would seem to them a waste of funds on "half control".

The Water Quality Board also fails to understand the Supervisors' statement: "We realize that an optimum 8000 cfs flow is not achievable," inasmuch as the Corps' study indicates that such a cfs flow is indeed achievable.

Thank you for allowing the Council this input. Its Board of Directors urges you to consider seriously, and with further study, the deepening and widening of Cache Creek for flood control on Clear Lake.

Yours truly,

Bonny Hanchett

Bonny Hanchett, President
Clear Lake Water Quality Council

THE WESTERN PACIFIC RAILROAD COMPANY
SACRAMENTO NORTHERN RAILWAY
TIDEWATER SOUTHERN RAILWAY CO.

WESTERN PACIFIC BUILDING, 526 MISSION STREET
SAN FRANCISCO, CALIFORNIA 94105
TELEPHONE 982-2100

RECEIVED BY
LAKE COUNTY FLOOD CONTROL
& WATER CONSERVATION DIST.
FEB 24 1978

February 23, 1978

File: L-8530

Mr. Willard D. Hansen, Manager
Lake County Flood Control & Water
Conservation District
255 North Forbes Street
Lakeport, CA 95453

Dear Mr. Hansen:

We have received your February 14, 1978 Announcement of Public Meeting on Cache Creek Basin Investigation in Lake & Yolo Counties.

Page 9 and Plate 3 showing the settling basin and wildlife refuge designates the railroad as shown as "SPRR". This should be "SNRR", the designation for Sacramento Northern Railway a part of the Western Pacific Railroad System.

Very truly yours,

A. W. CARLSON, Chief Engineer

By
J. C. Miller

TOOBY FARMS
2500 EAST FOOTHILL BOULEVARD SUITE 508 • PASADENA, CALIFORNIA 91107
213-792-5690

April 5, 1978

U.S. Army Corps of Engineers
Sacramento District
Attention: Investigations Section A
650 Capitol Mall
Sacramento, California 95814

Gentlemen:

We have attended the workshop meeting of March 9th at Clear Lake Highlands and the public meeting of March 20th at Woodland with regard to the proposed modification of the Cache Creek Basin.

As owner of some 500 acres of prime tomato and row crop ground, a portion of which is included in tentative plans for the expanded basin and wildlife refuge, we have a natural interest in the project.

We will be happy to co-operate in any way. It seems to us, however, that we should urge you and those planning this project to use every practical means to so plan the project that it does not include any of our property.

As we are located on the Northeast corner of the basin and have not experienced any flooding for many years this should not be a complicated engineering job.

We also urge this because the land is very expensive and the removal of the proposed acreage would affect the economic operation of the rest of the farm.

Lastly we think that unless absolutely necessary prime agricultural land should not be taken out of production for use as a settling basin.

Sincerely,

George Tooby

GT/jm

SIERRA CLUB
DAVIS "YOLANO" GROUP
1508 MADRONE LANE
DAVIS, CA 95616

April 23, 1978

U.S. Army Corps of Engineers
Sacramento District
ATTENTION: Investigations Section A
650 Capitol Mall
Sacramento, California 95814

Gentlemen:

After examining the Cache Creek Basin Feasibility Report and attending the March 20, 1978 public hearing regarding the proposed plans, we would like to express our basic support for those selected. The Davis Yolano Group of the Mother Lode Chapter of the Sierra Club was formed here about a hear-and-a-half ago and has no long tradition of involvement in the deliberations of the problems of flood control at Clear Lake nor of sedimentation associated with Cache Creek. Nonetheless, even though we are new in the area, we feel a direct interest in the problems of the Cache Creek, particularly those associated with the Lower Basin. Without having had the benefit of an historical concern as a group, we have come late to the entire issue and wish now at this point in the deliberations to say we appreciate the environmental concerns addressed by the plan and hope to see these concerns verified by minimal interference with wildlife (to include bird nesting schedules) and with riparian vegetation during the construction period. Further, we hope that appropriate monitoring of post-project environmental effects will be considered as an inherent part of the whole. We also trust that further commercial lakeside development at Clear Lake will strictly adhere to those regulations designed to preclude future complications similar to the ones being dealt with now.

Please inform us of the progress of the project when appropriate and at any time that further public input on this matter is desired.

Sincerely,

Ada Merhoff

Ada Merhoff, Conservation Committee
Chairperson

Marilyn Glad

Marilyn Glad, Yolano Group
Chairperson

MG

March 24, 1978

Board of Directors
Lake County Flood Control
And Water Conservation District
255 North Forbes Street
Lakeport, California 95453

Dear Sirs:

We are not in favor of the construction of the Cache Creek Bypass because the cost is prohibitive, it would displace too many homes, and because we do not need it.

In the 24 years that we have had our property on the lake we have been flooded badly twice, 1953 and 1970. In other years we have had water in our boathouse, but the amount of our losses over these years would never equal the cost to us of the Bypass.

Rimlanders need a tax break, not an increase. Lakefront property already is assessed much higher than off shore lands. We are slated to pay lease fees to the County for any encroachments beyond zero Rumsey. With the State Lands Commission laying claim to our beachfront property we also face the possibility of paying lease fees to the State. Hopefully the courts will recognize the injustice of this land grab effort and will rule against the State Lands Commission.

AN EFFICIENT OPERATION of the Cache Creek dam will and can prevent the flooding of Clear Lake. Since the water in the proposed bypass would return to the Creek and end up at the same dam we would still have to depend on Yolo opening the flood gates early enough to prevent our being flooded. Seems like a simple solution.

In the flood years the gates were opened at 7.56 ft.-too late! This year the gates were opened at 7.10 ft. and that helped as we did have more rain and the lake level went above 8 ft. in just a few days. If the Yolo Water District will cooperate to their utmost, we will have no floods on Clear Lake.

In our lay opinion Cache Creek doesn't need extensive widening. Debris accumulated over the years should be removed to allow an unimpeded flow of water. This should have been done during the last two dry years as suggested by the Lakebed Committee.

We support the NO Action Plan of the Army Corps of Engineers and urge you to do the same.

Sincerely,

Mr. and Mrs. Sidney R. Sutton
Star Rt. L, Box 550
Clearlake Park, CA 95424

Copies to:

Army Corps of Engineers
Yolo County Flood &
Water Conservation District

March 28, 1978

Army Corpsof Engineers
650 Capitol Mall
Sacramento, California 95814

Gentlemen:

I found the public meeting on March 21 quite interesting. The mammouth project proposed by the U.S. Army Corps of Engineers may be too extensive for what is truly necessary to flood-proof future facilities somewhat below the 11.85 Rumsey level.

I would like to see a graphic presentation with the following pertinent information:

1958 and 1970 flood stages as on record.
Projection of those flood stages superimposed if:
- Discharge rate @ 7.56 Rumsey was 4000 CFS
- Discharge rate @ 7.56 Rumsey was 5000 CFS

With a very well defined operating procedure that would anticipate severe rain storms and runoff, I predict good flood protection from the above discharge rates.

This flow rate could easily be accomplished within the existing channel and would have the following benefits:

1. No relocation, yielding less initial cost to the county.
2. Provide a very servicable channel for navigation.
3. Less interest to pay.
4. Less to amortize.
5. Less operation and maintenance cost.

No matter what agency the money comes from, it's our pocket money your spending. So include in your design criteria:

1. Maximum Federal expenditure, Upper Basin $2,000,000.00.
2. Local expenditure as close to zero as possible.

This plan may give as good of a cost-to-benefit ratio, but not be as cost efficient per cubic yard of material moved. But the bottom line is that I am talking about one-third the expenditure of your current favored proposal.

Yours truly,

Paul E. Racine

2515 Clipper Lane
Lakeport, CA 95453

March 29, 1978

Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Attention: Mark Capik

Re: Cache Creek Flood Control Project

Dear Mr. Capik:

As a native of Lake County and a life-long observer of Clear Lake and Cache Creek, I have observed several attempts to increase the flow from Clear Lake down Cache Creek, each attempt successful to a limited degree. I now look with interest at the Army Corps' plans to complete this very necessary project of giving flood protection to the low lands around Clear Lake and along Cache Creek.

After studying the Corps' several different Cache Creek flood control plans, and after two days of on-the-site inspection, bridge measurements, etc., I am firmly convinced that the only practical and just way to achieve all the desired results would be your plan of deepening the present channel and widening where possible, discussed as "Flood Control Alternative 2" (Page 10 and facing) in your Information Brochure, Cache Creek Basin Investigation, of November, 1975.

It has been agreed by those studying the situation that the present channel of the Creek, from the Lake to the concrete highway bridge, could be widened on the south side, and deepened, without disturbing any homes. Furthermore, it is indicated on the fold-out map of your "Alternate 2 Plan" of flood control without bypass, and it has been stated by your engineers, that very little widening would be necessary between the bridges and for some distance downstream, and that the channel would need to be deepened about ten feet, only.

However, if more width than was at first indicated should be required, it would be possible, according to my observations, to widen the present channel as much as thirty feet under each of the present bridges. And, if still more flow capacity should be needed, the banks above and below each bridge could be streamlined with concrete so that there would be very little loss in velocity at these points.

Advantages, as I see them, to just deepening and widening the present Cache Creek Channel, where necessary, are several:

1. A deepening and widening of the present channel would be much less disruptive of the entire Creek area than would the bypass plan--land-wise and people-wise.

2. Because "Alternative 2" would not require the buying of as much extra land and the construction of the extra facilities required under the bypass plan, it would seem reasonable to expect that the total cost of enlarging the present channel could be less than the cost of a bypass.

3. Certainly the cost of maintenance of the enlarged channel would be negligible in contrast to the cost of maintenance and operation of the bypass and facilities.

4. Besides achieving the primary purpose of flood control, a deep water channel from Clear Lake to the Dam all year round, every year, would have been opened up. Boating on this very scenic waterway is possible at present only during high water, because of the many obtrusive rocks and shallow spots which would have been removed during the deepening-widening process. Such an improved, all-year channel as would result would be of inestimable value, both recreationally and aesthetically -- not only to the property owners along Cache Creek, but also to those throughout Lake County and all of California. It would make possible many thousands of man-days of water recreation, with increased boating, swimming, and fishing -- all with much-improved water quality... Furthermore, the Creek would be made safer for swimming and boating, with the increased cross-section of the water in the Creek decreasing the velocity of the stream during the irrigation withdrawal season.

The disadvantages of a new bypass channel around part of the present channel would seem to be many:

1. The bypass channel project would take many acres of valuable land away from other productive uses and off the tax rolls.

2. It would require the construction of two new bridges, one for the highway and one also for the county road.

3. It would require two concrete flow-restricting weirs.

4. The weir in the old channel would be irritatingly restrictive to travel and would require flash-boards that must be manually placed and removed to regulate flow in both channels. The maintenance and operation of such a complicated arrangement would prove an unnecessary financial burden to Lake County as well as an impediment to access.

5. If the bypass is to remain a "live" channel, it would require a flow of water the year around, which requirement would take part of the flow from the undeepened part of the old channel, where the water is already insufficient in the late summer. It must be remembered that property owners on this part of the old channel have the legal and moral right to conditions at least as good as they are now.

6. Residential development of this entire area, already planned, would be halted until a final resolution of the conflicting problems could be made. This could take years. Who would recompense the land owners in the bypass area for their financial loss?

In conclusion, I reiterate the carefully considered opinions I have expressed in person and now in writing. Although I have no great personal interest in flood control on Clear Lake, not living at a flood level, I still -- because of my life-long concern for the Lake -- would like to see the tragedies from the flooding alleviated. And, I would like to see it done effectively, with as little disruption of the Creek area as possible, and with as little maintenance cost as possible. Furthermore, if an additional benefit in the form of an enhanced waterway could derive from the project -- so much the better. For these various reasons, I cannot urge you too strongly to reconsider seriously, and with detailed planning, your "Alternative 2 Plan" for Cache Creek.

Sincerely yours,

John L. Jago

John L. Jago
P. O. Box 9
Lower Lake, California 95457

Advisory Council on
Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

March 8, 1978

Colonel Donald M. O'Shei
District Engineer
Sacramento District
Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Colonel O'Shei:

This is in response to your request of February 21, 1978, for comments on the feasibility report and draft environmental statement (DES) for the Cache Creek Basin Investigation, Lake and Yolo Counties, California.

Pursuant to its responsibilities under Section 102(2)(C) of the National Environmental Policy Act of 1969, the Council has determined that the DES does not demonstrate compliance with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f, as amended, 90 Stat. 1320). However, it appears that the Corps of Engineers understands its responsibilities and will carry them out in the future. Accordingly, we look forward to working with the Corps in accordance with the "Procedures for the Protection of Historic and Cultural Properties" (36 CFR Part 800) at the appropriate time.

Should you have any questions, please contact Michael H. Bureman at (303) 234-4946, an FTS number.

Sincerely yours,

Louis S. Wall
Assistant Director, Office of
Review and Compliance, Denver

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
2828 Chiles Road, Davis, CA 95616

March 30, 1978

Donald M. O'Shei
Colonel, CE
District Engineer
Department of the Army
Sacramento District
Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

SFKED-W

Dear Colonel O'Shei:

We acknowledge receipt of the draft environmental statement and feasibility report for Cache Creek Basin Investigation in Lake and Yolo Counties, California, that was addressed to the Soil Conservation Service on February 21, 1978, for review and comment.

We have reviewed the above draft environmental statement and feasibility report and find that there are no controversial items in the report within the realm of the Soil Conservation Service's expertise and responsibilities. We find no conflict with any SCS on-going or planned programs or projects.

We appreciate the opportunity to review and comment on this proposed project.

Sincerely,

FRANCIS C. H. LUM
State Conservationist

cc: R. M. Davis, Administrator, USDA, SCS, Washington, D. C. 20250
Fowden G. Maxwell, Coordinator of Environmental Quality Activities, Office of the Secretary, USDA, Washington, D. C. 20250
Director, Office of Federal Activities (Mail Code A-104), Environmental Protection Agency, Room 537, West Tower, 401 M Street, S.W., Washington, D. C. 20460

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230
(202) 377-3111

April 20, 1978

Colonel Donald M. O'Shei
Sacramento District, Corps of
Engineers
Department of the Army
650 Capitol Mall
Sacramento, California 95814

Dear Colonel O'Shei:

This is in reference to your draft environmental impact statement entitled, "Cache Creek Basin Investigation, Lake and Yolo Counties, California." The enclosed comments from the National Oceanic and Atmospheric Administration are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving eight (8) copies of the final statement.

Sincerely,

for Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosure: Memo from Dr. George P. Cressman
Director, National Weather Service

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

APR 19 1978

Reply to Attn. of: W2x2/AF

Date : APR 1 1978

To : Dr. William Aron
Director, Office of Ecology and Environmental Conservation, EE

From : Dr. George P. Cressman
Director, National Weather Service, W

Subject: DEIS 7803.24 - Cache Creek Basin, CA.

The Cache Creek Basin is identified in the EIS as being subject to high-intensity rainstorms that cause flooding within short periods of time, usually passing through the basin within a 24-hour period (pg 15). The NWS provides a river and flood forecast and warning service for Cache Creek at Yolo, Capay and Rumsey, and Lakeport on Clear Lake. No reference is made to the availability of these services as a non-structural approach to mitigating flood losses. This is considered an oversight.

Flash flood watches and flood warnings emanate from the NWS office in Sacramento. This office provides services as indicated in the enclosure and should be referred to in the DEIS. In addition, Sacramento has a long-range weather surveillance radar to assist in the early detection and monitoring of flash flood-producing storms.

Encl.

The National Oceanic and Atmospheric Administration (NOAA), National Weather Service, provides flood forecasting service for major river basins. This system involves predictions of anticipated stages at a particular gage or gages in the basin. These forecasts are based on observed precipitation and stages at upstream points and anticipated weather conditions. The flood forecast is transmitted to City officials, newspapers, and radio and television stations in the basin. These media disseminate the information to residents of the flood plain in the form of a flood warning. This timely forewarning permits protective measures to be undertaken by industrial plants, public utilities, municipal officials, and individuals with property in the lowlands. Services available are of the following types:

1. Flash Flood: The responsible Weather Service Forecast Office supplies weather forecasts twice daily for the State. In addition to the routine forecasts, special forecasts of severe storms and general flash flood watches for small streams are issued as required. WSR-57 Weather Radar installations have capability for immediate detection and evaluation of rainfall intensity, location, and storm movement. Information is promptly relayed by teletype circuits and telephone to news media and community officials and law enforcement agencies. The Weather Service Office issues Flash Flood Warnings as required for small streams in its area of responsibility.

2. Major Floods: River stage forecasts are based on radar coverage, reports from river and rainfall reporting stations and telemetry in or near the basin. The River Forecast Centers are staffed with professional hydrologists responsible for the preparation of river forecasts based on water equivalent of snow cover, rainfall-runoff relations, streamflow routing, and a working knowledge of anticipated weather conditions. The lead time between distribution of the forecasts and the flood crest may be short; however, lead time normally ranges from 12 hours for rainfall and up to several weeks for snowmelt. Specific crest forecasts are issued as required. River District Offices are responsible for the interpretation and distribution of flood forecasts and the operation of the hydrologic reporting substation network in its area of responsibility.

3. Hydroclimatic Data: Most of the data from the network is published. These records provide the basis for forecasts as well as for the planning and design of protective works and their operation during floods. River and Flood forecasting is fundamental in the design and essential in the operation of a levee or reservoir system.

FLASH FLOOD PROGRAM

In many communities the interval between heavy rainfall and flooding is too short for forecast preparation by the RFC. This generated the need for the present Flash Flood Program.

Three alternate methods are used to prevent loss of life and alleviate property damage in flash flood situation. These are: 1) self-help forecast procedures 2) Flash Flood Alarm Systems (FFAS), and 3) generalized flash flood watches and warnings. Selection of a method for a specific community depends on the hydrologic nature of the problem in that area. In some cases a combination of methods is used.

With the first method, a forecast procedure prepared by NWS officials is provided to a community official. He collects rainfall data and prepares the official forecasts required.

The FFAS is a specialized river gage which senses a pre-selected critical water level and sounds an alarm. The alarm portion of FFAS's is placed in some disaster oriented office, such as a police station which is always manned around the clock. Disaster officials warn endangered citizens and mointor upstream conditions to get an idea of the stage to be expected.

Areas which cannot be served by either of these methods must rely on flash flood watches and warnings. The watch means that conditions conducive to flooding are expected. Interested parties should stay informed and ready for immediate action if a warning is received or flooding is observed. The warning means that flooding is imminent or in progress and low areas should be evacuated immediately.

The success of any natural disaster warning program is dependent on community preparedness and pre-designed plans of action.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
Sacramento Area Office
2800 Cottage Way
Sacramento, California 95825

IN REPLY REFER TO:
Land Operations

APR 25 1978

Colonel Donald M. O'Shei
District Engineer
Sacramento District, Corps
of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Colonel O'Shei:

We have reviewed the draft environmental statement and feasibility report for Cache Creek Basin, Lake and Yolo Counties, California (ER 78/182), and found no adverse impact upon any Indian lands under our jurisdiction.

Sincerely yours,

~~ACTING~~ Area Director

United States Department of the Interior
BUREAU OF MINES
EAST 315 MONTGOMERY AVENUE
SPOKANE, WASHINGTON 99207

Western Field Operations Center
March 29, 1978

Colonel Donald M. O'Shei, CE
District Engineer
U.S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Re: Review of Draft Environmental Statement and Feasibility Report For Cache Creek Basin, Lake and Yolo Counties, California (ER-78/182)

Dear Colonel O'Shei:

We have reviewed the Draft Environmental Statement (DES) and Feasibility Report for Water Resource Development in Cache Creek Basin, Lake and Yolo Counties, California.

Although mineral resource availability is an important aspect of water resource development, reference to minerals is lacking in this report. According to the Bureau of Mines Mineral Industry Location System (MILS) files, mineral production has come from mercury, pumice, volcanic cinders, sand and gravel, and stone operations. In addition, over 150 prospects have been examined in Cache Creek Basin for alumina, antimony, asbestos, clays, chromite, copper, diatomite, garnet, gold, gemstones, limestone, manganese, mica, sulfur, and tin. Geothermal well sources also have been identified. None of these commodities are mentioned or acknowledged in the draft environmental statement. This oversight should be corrected.

Sincerely yours,

R. N. Appling, Jr., Chief
Western Field Operation Center

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

STATE OFFICE
Federal Office Building
2800 Cottage Way
Sacramento, California 95825

IN REPLY REFER TO
1793 (Corps)
(C-911.4.5)

APR 20 1978

Colonel Donald M. O'Shei
Corps of Engineers, District Engineer
Sacramento District, 650 Capitol Mall
Sacramento, California 95814

Dear Colonel O'Shei:

The Bureau of Land Management has reviewed the Draft Environmental Statement and Feasibility Report for Cache Creek Basin in Lake and Yolo Counties, California. Approximately four of the twenty-three miles of Cache Creek between Clear Lake and Rumsey is administered by the BLM. Although Cache Creek flows through a fairly narrow, steep sided canyon when on federal land, we can expect the stream channel to widen. Bank under cutting and failures will occur and may result in some loss of riparian habitat and increased stream silt loads. We have no way of assessing the loss but we would estimate no major impact.

Sincerely,

Ed Hastey
State Director

cc: Director (260)
District Manager, Ukiah

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

United States Department of the Interior

BUREAU OF RECLAMATION

MID-PACIFIC REGIONAL OFFICE
2800 COTTAGE WAY
SACRAMENTO, CALIFORNIA 95825

IN REPLY REFER TO: MP-150

APR 7 1978

Donald M. O'Shei
Colonel, CE
District Engineer
Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel O'Shei:

As requested by your letter of February 21, 1978, we have reviewed the Cache Creek Basin draft "Feasibility Report and Environmental Statement for Water Resources Development" dated February 1978. The selected plans would have no major impact on Bureau facilities or ongoing activities. There may be some minor alteration of water supply yield which will need to be taken into consideration during the West Sacramento Canal Unit water requirements study. We see no other potential complication at this time.

The alternatives considered in the report are familiar to members of my staff through attendance at various public meetings and inter-staff coordination between our two agencies. Those alternatives presented in the draft environmental statement are, in our opinion, adequate to provide the various levels of protection noted in the document.

Sincerely yours,

H. E. Horton

H. E. Horton
Acting Regional Director

Copy to: Commissioner, Washington, D.C.
Attention: 150
Director, Office of Environmental
Project Review

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Area Office
2800 Cottage Way, Room E-2740
Sacramento, California 95825

MAY 3 1978

In reply refer to: ES-S

Colonel Donald M. O'Shei
District Engineer
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California

Dear Colonel O'Shei:

We have been requested by the Department of the Interior's Office of Environmental Project Review to provide the Corps of Engineers with the Fish and Wildlife Service's comments on this draft feasibility report and draft environmental statement for the Cache Creek Basin Investigation, Lake and Yolo Counties, California.

The Service will soon complete a detailed report of the impacts of the proposed project on fish and wildlife resources. That report, which is intended to accompany your feasibility report when submitted for Congressional action, will present recommendations for any modification of the project plan that may be required to protect and enhance fish and wildlife resources. At this time, we have the following comments to submit on the draft documents.

Draft Feasibility Report

Page 6, 4th paragraph: Clarification is needed in regard to rare, endangered, and threatened species. For the species mentioned, it should be indicated which classification each falls into and whether it is on the State or Federal list.

Page 63, Recommendations: We fully support your tentative recommendation that a national wildlife refuge be established at Cache Creek Settling Basin.

Save Energy and You Serve America!

Draft Environmental Statement

Page 6, Section 2.06: As before, clarification is needed concerning rare, threatened, and endangered species.

Page 14, Section 4.04: It should be noted that there would be a large short-term loss of aquatic productivity in the outlet channel due to construction activity. That loss could be partially offset by the provision of fish habitat structures. Additionally, the modified channel would, over time, approach but never fully regain its present level of productivity.

Page 27, Section 7.01: Several points in this section require amplification or clarification. We cannot agree that this project would provide any additional protection for riparian habitat along the outlet channel and elsewhere. From a fish and wildlife perspective, the occasional flooding of the rim of Clear Lake is more likely to be beneficial than damaging. We do not concur in the statement that fish and wildlife numbers with the project would exceed those present without the project. At best, and only with the incorporation of compensation features, postproject animal numbers would equal preproject levels.

The opportunity to review and comment on these documents is appreciated.

Sincerely yours,

Gene G Gates

ACTING Area Manager

cc: FWS, ES/EC, Washington, D.C.

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

OFFICE OF THE DIRECTOR

In Reply Refer To:
EGS-ER-78/182
Mail Stop 760

APR 11 1978

Colonel Oonald M. O'Shei
District Engineer
U.S. Army Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Colonel O'Shei:

We have reviewed the draft feasibility report and environmental statement for Cache Creek Basin, California.

It would be useful to have more specific information concerning gravel excavation within the channel reach of Cache Creek between Capay and just upstream of the Cache Creek Project levees. This information would be helpful in assessing effects of increased gravel excavation on the structural integrity of bridge crossings (app. 1, p. C-22, par. 33).

Thank you for the opportunity to provide comment.

Sincerely yours,

Henry W. Coulter

Acting Director

United States Department of the Interior

HERITAGE CONSERVATION AND RECREATION SERVICE
PACIFIC SOUTHWEST REGION
SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO: E3027
ER 78/182

APR 19 1978

Colonel Donald M. O'Shei
Oistrict Engineer
Corps of Engineers
650 Capital Mall
Sacramento, CA 95814

Dear Colonel O'Shei:

We have reviewed the draft environmental statement and feasibility report for the Cache Creek 8asin water resource developments, in Lake and Yolo Counties, California, and offer the following comments for your consideration.

The environmental impact statement adequately discusses impacts upon recreation resources near the Clear Lake channel outlet as well as in the area of the Cache Creek settling basin. The proposed improvements and the establishment of the wildlife refuge, if implemented, should substantially improve the quality and availability of passive and consumptive recreation opportunities as well as environmental education experiences to the local and regional communities with only minor and temporary disturbances to the existing recreation resources. To insure minimal disruption, we recommend that all major construction operations be scheduled to coincide with low-use recreation periods.

We appreciate having the opportunity to review this study.

Sincerely yours,

James R. White

For Frank E. Sylvester
Regional Oirector

cc: OEA, HCRS, WASO

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

United States Department of the Interior

NATIONAL PARK SERVICE

WESTERN REGION
450 GOLDEN GATE AVENUE, BOX 36063
SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO
L7619
(WR)REQ

April 4, 1978

Col. Donald M. O'Shei
District Engineer
Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel O'Shei:

We have reviewed the Draft Environmental Statement and Feasibility Report for the Cache Creek Basin Investigation, Lake and Yolo Counties, California and offer the following comments for your consideration.

Although it is stated on page 14, appendix 4, that "all areas of planned earth movement" have been surveyed for cultural resources, it is indicated on page B-18, appendix 1, that only preliminary work has been done in the lower reaches of Cache Creek. The final environmental statement should address the potential effects that implementation of the proposed Lower Basin (Cache Creek) plan may have upon cultural resources. The high density of cultural resources revealed in the area to date would necessitate an intensive survey of the area be performed in the early stages of project planning to allow for adequate consideration of the resources.

We concur with the recommendation included in the letter from the State Historic Preservation Officer, dated November 4, 1977, that input concerning located cultural resources be solicited from the Native American community. The final environmental statement should satisfactorily address this issue.

In addition, the final statement should document that the State Historic Preservation Officer has been consulted to determine if there are any properties listed on, pending, or eligible for nomination to the National Register of Historic Places in the project area.

Sincerely yours,

Bruce M. Kilgore

Bruce M. Kilgore
Associate Regional Director,
Resource Management and Planning

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION NINE

ARIZONA
CALIFORNIA
NEVADA
HAWAII
GUAM
AMERICAN SAMOA

Two Embarcadero Center, Suite 530
San Francisco, California 94111

June 1, 1978

IN REPLY REFER TO
HED-09

Colonel Donald M. O'Shei
Sacramento District Engineer
U.S. Army Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Colonel O'Shei:

We have reviewed the Draft Feasibility Report and Environmental Impact Statement for the Cache Creek Basin Investigation, Lake and Yolo Counties, California, and provide the following comments:

1. The proposed bypass channel will require the construction of new bridges on two Federal-aid highway routes: State Highway 53 (FAP-53) and old Highway 53 (FAS-V102). Page E-13 of Appendix 1 states that the construction of the new bridges is a local interest responsibility. However, the Federal-aid Highway Program Manual 6-1-1 (PPM 5D-4.2), copy enclosed, indicates that construction on existing highway facilities necessitated by the construction of a water resources development project shall be the full responsibility of the water resources development agency. Therefore, please be advised that the construction of the new bridges is not eligible for Federal-aid highway funding, except as may be required for expansion of the facilities to meet future traffic demands.

2. In addition, we have been advised verbally by the CALTRANS District 01 Office that they have submitted written notification to the Corps of Engineers that they do not intend to expend State highway funds on the construction of a new bridge on State Route 53 (FAP-53). CALTRANS believes such construction to be the responsibility of the Corps.

We appreciate this opportunity to review the subject documents and would like to receive two copies of the Final Statement when it becomes available.

Sincerely yours,

Mitchell Tanner

for R. G. S. Young, Director
Office of Environment and Design

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

D-COE-K36026-CA

Donald M. O'Shei, Colonel
District Engineer
Sacramento District
U.S. Corps of Engineers
650 Capitol Mall
Sacramento CA 95814

MAY 10 1978

Dear Colonel O'Shei:

The Environmental Protection Agency has received and reviewed the draft environmental statement for the Cache Creek Basin Investigation, Lake and Yolo Counties, California.

EPA's comments on the draft environmental statement have been classified as Category LO-2. Definitions of the categories are provided on the enclosure. The classification and the date of EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and the adequacy of the environmental statement.

EPA appreciates the opportunity to comment on this draft environmental statement and requests three copies of the final environmental statement when available.

If you have any questions regarding our comments, please contact Betty Jankus, EIS Coordinator, at (415)556-6695.

Sincerely,

Paul De Falco, Jr.

Paul De Falco, Jr.
Regional Administrator

Enclosure

cc: Council on Environmental Quality

Air Quality Comments

1. The draft statement contains no statement of existing air quality. This concern should be addressed for each air pollutant for which a National Ambient Air Quality Standard exists.

2. The final statement should discuss the project's related emission in comparison to existing ambient levels and any violations of the National Ambient Air Quality Standards (NAAQS).

3. The area has been designated as non-attainment for oxidants (Ox)(43 FR 88962)(3/3/78). This should be discussed in the final statement.

4. There is no comparison of air quality with respect to alternatives. The final statement should consider a comparison.

Water Quality Comments

1. The draft statement (page 18, Section 408) states that the proposed construction activities would adversely impact water quality by increasing turbidity. The final statement should address this impact by including mitigating measures that would reduce turbidity and any negative impacts on the aquatic resources of the basin.

2. The secondary impacts of the effect of stabilizing Clear Lake need to be analyzed in more detail. Eliminating the factor of flooding would encourage growth. Are there any landuse constraints against development along the shoreline of the lake? The final statement should indicate how much growth would take place along the lake and how would this impact agricultural land.

3. Since there will be more recreational activities on Clear Lake due to its stabilization, the final statement should address alternatives for solving the algae problem on the lake. The report states "when wind-swept to the shoreline, the algae die, producing an unsightly appearance and giving off an unpleasant

odor to the detriment of recreation, which is one of the major beneficial uses of the lake." More detail is needed in what is being done to solve this problem.

4. What alternative is available if the Gopcevic Decree of 1920 and the Bemmerly Decree of 1940 cannot be modified?

EIS CATEGORY CODES

Environmental Impact of the Action

LO--Lack of Objections

EPA has no objection to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER--Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU--Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1--Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2--Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3--Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to tha impact statement.

If a draft impact statement is assigned a Category 3, no rating will be mada of tha project or action, since a basis does not generally exist on which to make such a determination.

CACHE CREEK BASIN, CALIFORNIA

FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT
FOR WATER RESOURCES DEVELOPMENT

LAKE AND YOLO COUNTIES, CALIFORNIA

Gopcevic and Bemmerly Decrees

APPENDIX 3

PREPARED BY THE
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA,

IN AND FOR THE COUNTY OF MENDOCINO

M. M. GOPCEVIC, and THE HOTALING ESTATE CO., a corporation, and GEORGE T. RUDDICK, Plaintiffs, vs. YOLO WATER AND POWER COMPANY, a corporation, and YOLO WATER AND POWER CORPORATION, a corporation, Defendants, COUNTY OF LAKE and LISLE STUBBS et al, Intervenor	DECREE

Pursuant to the stipulation of all parties herein reduced to writing and filed in open court on the 7th day of October, 1920, agreeing and consenting that the following judgment and decree be entered in the above entitled action, and upon evidence taken; and finding being waived in open court by all parties;

IT IS HEREBY ORDERED ADJUDGED AND DECREED AS FOLLOWS:

That the defendant herein be perpetually enjoined and restrained from excavating or deepening the outlet of Clear Lake, being the Clear Lake mentioned in the pleadings herein, to any depth greater than four feet below the zero mark on the Rumsey gauge at Lakeport, County of Lake, State of California, which said gauge is hereinafter more particularly referred to; and from widening straightening or otherwise interfering with said outlet, except as may be necessary to carry out the provisions of this decree, all of such work to be with the approval first obtained and under the supervision of the State Railroad

Commission of California, or the members thereof; and this injunction shall include the said defendants, their and either of their, officers, agents, servants, employees successors and assigns, and each and all officers and agents of either of them, and all persons acting under or in aid of them or either of them.

That the agents, servants, employees, successors and assigns of the said defendants and the said defendants and each of them, and all persons acting under or in aid of them or either of them be perpetually enjoined and restrained from at any time, or in any way raising the level of said lake in excess of 7.56 feet above zero on said Rumsey Gauge, and from at any time or at any way lowering the level of said lake below zero on said Rumsey Gauge; provided, however, that the rise of said Clear Lake, by reason of storm or flood conditions beyond the control of said defendants, or either of them, to a level in excess of 7.56 feet above zero on said Rumsey Gauge, but in no event to a level in excess of 9.00 feet above zero on said Rumsey Gauge, for any period not exceeding ten successive days, shall not be deemed a violation hereof;

The zero mark on said Rumsey Gauge is 20.1 feet below center of large concrete star in northeast corner of court house yard at said Lakeport, and 21.56 feet below iron step at front entrance to Bank of Lake Building at southeast corner of Main Street and Second Street, in said Lakeport;

That said defendants, and each of them, their officers, agents, employees, successors and assigns and all persons acting under or in aid of them or either of them, be perpetually enjoined and restrained from drawing off from said Clear Lake an amount of water which, inclusive of evaporation and other losses, will at any time reduce the level of said lake below zero on said Rumsey Gauge; and the said defendants, and each of them, their officers, agents, employees, successors and assigns, be perpetually enjoined and commanded to draw off from said lake an amount of water which, inclusive of evaporation and other losses will reduce the level of the lake so that the elevation thereof on the following dates shall not exceed the following percentages of the actual level on April 15th of each year;

May 1, 97%, June 1, 89%, July 1, 79%, August 1, 69% and September 1, 58%.

That said defendants and each of them, their officers, agents, employees successors and assigns, be perpetually enjoined and restrained from drawing off from said lake, during the irrigation season an amount of water which, inclusive of evaporation and other losses shall lower the level of said lake more than two feet in any one month;

It is hereby specially adjudged and decreed that notwithstanding the limits of depression of said lake waters hereinabove described the said defendants, and each of them, their agents, employees, successors and assigns, shall not draw off or allow, and they and each of them are enjoined and restrained from drawing off or allowing the waters of said lake to flow out of said lake at any time at such a rate as that, taking into account evaporation and other losses, the water of said lake shall at the lowest level of any year be below zero on said Rumsey Gauge;

It is further adjudged and decreed that the said defendants or either of them, shall at or about the specific dates last hereinabove mentioned, notify in writing, through the mails or otherwise, the parties hereto and as well such owners or occupants of land on the rim of said lake as shall register their names and addresses with the defendant, Yolo Water and Power Company, at its office in Woodland, Yolo County, California, of the then existing and respective levels of the said lake.

The drawing off of the water of said lake under the conditions aforesaid, shall be by and through the dam and gates mentioned in the pleadings herein, and the administration conduct and operation of said dam and gates shall be responsive to and in full and fair execution of such conditions, and shall at all times be by and under the State Railroad Commission of California, or the members thereof;

If at any time the injunctive provisions of this decree shall be violated, or departed from in the matter of substance and all the provisions of this decree are for this purpose taken to be injunctive then and in such events the said defendants and each of them are hereby enjoined and commanded forthwith thereupon, in the manner and to the extent hereinafter provided, or in default thereof it shall be competent to the plaintiffs or any or either of them, or in default of action in the promises by the plaintiffs or any or either of them, it shall be competent to the interveners, or any or either of them, and said parties are accordingly hereby authorized, at the expense of defendants, their successors and assigns to restore and maintain at the "Grigsby Riffle" mentioned in the complaint herein, but above the present mouth of "Seigler Creek" a suitable and substantial structure or barrier, the crest of which shall not exceed one foot above zero on said Rumsey Gauge except as hereinafter provided;

But it is further and specifically decreed that if at any time, for any physical reason, or otherwise, said dam should cease in any substantial sense, to function in respect to the operation of the same as hereinabove referred to, then and in that event the crest of the aforesaid structure or barrier may be increased and maintained to an

elevation of two feet above zero on said Rumsey Gauge, said structure and barrier shall exist and be maintained at all times when a dam shall cease to function as provided in this decree for the operation of the same; provided however that the failure of the defendants or either of them to comply substantially with the terms of this decree, due to temporary, unavoidable causes shall not be deemed a violation of this decree;

It is further adjudged that this decree does not adjudicate upon the extent of the several riparian or littoral rights of any of the parties hereto in the said Clear Lake or the land adjacent thereto nor upon any rights or claims of any of said parties to water rights therein, nor in or over such adjacent lands, and that the injunctive relief hereby granted and provided for is not based upon a waiver by any of said parties of any such substantive rights of claims aforementioned but is subject to full reservations on the part of all and each of said parties of all said substantive rights or claims aforesaid;

It is further ordered adjudged and decreed that the said dam and the operation thereof shall at all times be subject to reasonable access and inspection by the parties hereto as well as any person owning land riparian or littoral to said Clear Lake and their duly authorized agents or attorneys; but if any question should arise in respect to the right of any such person or persons to such access and inspection, the same shall be remitted to the state railroad commission (SIC) of California, or the members thereof for final determination; That all claims for damages involved in this action or on account of the issuance of the temporary restraining order or preliminary injunction herein are waived and adjudged to be fully settled;

That each party to this action shall pay his own costs.

The signing and filing of this decree shall be deemed to be noticed of the terms thereof and effective as service of any injunctive process consequent thereon.

Done in open Court the 7th day of October, 1920.

A. B. McKenzie
Judge.

CERTIFIED: October 7th, 1920 by the Clerk of said Court to be a full, true and correct copy of the original on file and of record in his office.

ENDORSED: Filed Oct. 7, 1920, HALE PRATHER, Clerk
By W. H. PRATHER, Deputy

RECORDED: October 8th, 1920, in Vol. 60 of Deeds, at page 49. Records of Lake County California.

C. C. McDonald,
Attorney for Plaintiffs,
Woodland, California

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA,

IN AND FOR THE COUNTY OF YOLO.

MARY E. BEMMERLY AND AGNES H. BEMMERLY, Plaintiffs, vs. THE COUNTY OF LAKE, a Political Subdivision of the State of California, E. L. HERRICK, W. E. REICHERT, L. D. KIRKPATRICK L. L. BURGER AND J. S. KELSAY, as and comprising the Board of Supervisors of the County of Lake, State of California, THE BOARD OF SUPERVISORS OF THE COUNTY OF LAKE, STATE OF CALIFORNIA, E. L. HERRICK, individually and as a member of the Board of Supervisors of the County of Lake, State of California, FRANK W. NOEL, individually, W. E. REICHERT, as a member of the Board of supervisors of the County of Lake, State of California, W. T. SMITH, individually, L. D. KIRKPATRICK, as a member of the Board of Supervisors of the County of Lake, State of California, L. L. BURGER, individually and as a member of the Board of Supervisors of the County of Lake, State of California, J. S. KELSAY, individually and as a member of the Board of Supervisors of the County of Lake, State of California, FRANK B. JOHNSON, individually and as a County Surveyor of the County of Lake, State of California, FRANK W. CLARK as Director of the Department of Public Works of the State of California, CLEAR LAKE WATER COMPANY, A CORPORATION, J. R. REEVES, JOHN DOE DREDGING COMPANY, RICHARD ROE DREDGING CO., FIRST DOE, SECOND ROE AND THIRD ROE, Defendants.	No. 881

J U D G M E N T

This cause having been regularly called and tried by the Court, and the findings of fact and conclusions of law, and the decision thereon in writing, having been rendered, wherein judgment was ordered in favor of the plaintiffs and against the defendants hereinafter named as prayed for in the complaint and for costs,

IT IS, BY THE COURT, ORDERED, ADJUDGED AND DECREED that the defendants, The County of Lake, a Political Subdivision of the State of California, E. L. Herrick, W. E. Reichert, L. D. Kirkpatrick, L. L. Burger and J. S. Kelsay, as and comprising the Board of Supervisors of the County of Lake, State of California, the Board of Supervisors of the County of Lake, State of California, E. L. Herrick, individually and as a member of the Board of Supervisors of the County of Lake, State of California, Frank W. Noel, individually, W. E. Reichert as a member of the Board of Supervisors of the County of Lake, State of California, W. T. Smith, individually, L. D. Kirkpatrick as a member of the Board of Supervisors of the County of Lake, State of California, L. L. Burger, individually and as a member of the Board of Supervisors of the County of Lake, State of California, J. S. Kelsay, individually and as a member of the Board of Supervisors of the County of Lake, State of California, Frank B. Johnson, individually and as County Surveyor of the County of Lake, State of California, Frank W. Clark, as Director of the Department of Public Works of the State of California, and Clear Lake Water Company, a corporation, and each and all of them, and their, and each of their attorneys, agents, servants and employees and any and all persons acting under said defendants, or any of them, be, and they and each and all of them are hereby forever enjoined and restrained from in any manner widening, deepening or enlarging the arm or slough which constitutes the outlet of the waters of and from Clear Lake into Cache Creek and from in any manner changing the said outlet so as to increase the flow of waters of and from Clear Lake into Cache Creek. The Clear Lake herein referred to is the Clear Lake described in the plaintiffs' complaint and which is located in the county of Lake, State of California.

IT IS FURTHER ORDERED, ADJUDGED AND DECREED that plaintiffs have judgment for their costs taxed at   Dollars ($).

Judgment rendered December 18th, 1940.

/s/ Dal M. Lemmon
Judge of the Superior Court

CACHE CREEK BASIN, CALIFORNIA

FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT
FOR WATER RESOURCES DEVELOPMENT

LAKE AND YOLO COUNTIES, CALIFORNIA

Environmental Statement

APPENDIX 4

PREPARED BY THE
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

This revised draft environmental statement is an accompanying document to the feasibility report and, to avoid duplication, many items already discussed in detail in the feasibility report (particularly descriptions of the present environment) are not repeated in this revised draft. Letters and numbers appearing in parenthesis refer to sections and pages in Appendix 1 where more detailed information appears. Letters of comment received on the draft environmental statement, as well as responses to those comments, are included in Appendix 2. Many revisions and clarifications suggested in the letters of comment have been incorporated into this revised draft and the feasibility report.

SUMMARY

Cache Creek Basin, California, Investigation
Revised Draft Environmental Statement

Responsible Office: U.S. Army Engineer District, Sacramento, California

1. Name of Action: ( ) Administrative (X) Legislative

2. Description of Action: The proposed plan includes construction of flood control facilities at the outlet of Clear Lake in Lake County, California, to provide flood protection to existing and future urban and agricultural development on the Clear Lake rim. The plan calls for widening and deepening the existing Clear Lake Outlet Channel, constructing a bypass channel, and requiring future development to flood proof to the elevation of the preproject flood plain. The plan also includes sediment control on Cache Creek in Yolo County, California, to preserve the integrity of the Sacramento River Flood Control Project. The plan for the settling basin calls for enlarging existing perimeter levees, reconstructing and enlarging the existing Cobble Weir, rebuilding existing training levees, establishing a wildlife refuge, and annually excavating sediment.

3. a. Environmental Impacts: Property damage and other adverse environmental impacts associated with severe flooding would be alleviated. Wildlife and public recreation benefits would accrue at the settling

basin. The integrity of existing flood control facilities would be maintained.

b. Adverse Environmental Impacts: About 71 acres of grassland and 3 acres of riparian forest would be converted to a flood control channel. Approximately 250 acres of agricultural land would also be occupied by project features, and agricultural production on an additional 3,350 acres would be reduced because of wildlife area operation. Temporary impacts would accrue to resident fish and wildlife, water quality, air quality, and esthetics but would be mitigated. Thirteen residences require relocation.

4. Alternatives: No action, flood forecasting, evacuation of the flood plain, flood proofing, construction of reservoirs, modification of Clear Lake operation, and several combinations of these were considered for the upper basin. No action, nonstructural, basin excavation, new basin construction, Kellner jetty system, a sediment reservoir, and several combinations of these were considered for the lower basin.

5. Comments Received:

a. Federal agencies

(1) Department of the Interior

Bureau of Indian Affairs

Bureau of Land Management

Bureau of Mines

Bureau of Reclamation

Fish and Wildlife Service

Geological Survey

Heritage Conservation and Recreation Service

National Park Service

(2) Department of Agriculture

Soil Conservation Service

(3) Environmental Protection Agency

(4) Federal Highway Administration

(5) Department of Commerce

(6) Advisory Council on Historic Preservation

b. State agencies

(1) Resources Agency

(2) Department of Transportation

c. Local agencies and citizens groups

(1) Lake County

(2) Yolo County

(3) Clear Lake Water District

(4) Lake County Flood Control and Water Conservation District

(5) Yolo County Flood Control and Water Conservation District

(6) Audubon Society

(7) Sierra Club

(8) Clear Lake Water Quality Council

(9) Yolo County Resource Conservation District

(10) City of Woodland

6. Draft to EPA 21 February 1978

Revised draft to EPA ________

CACHE CREEK REVISED DRAFT
ENVIRONMENTAL STATEMENT

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

SECTION I - PROJECT DESCRIPTION

1.01 Project location. - The Clear Lake-Cache Creek Basin lies in Central California about 90 miles north of San Francisco, on the eastern slope of the Coast Range (plate A-1). The basin includes portions of Lake, Colusa, and Yolo Counties.

1.02 Authority. - Problems and needs of the Cache Creek Basin are being investigated as part of the Northern California Streams comprehensive investigation in response to Congressional resolutions in 1946 and 1963.

1.03 Project purpose. - The proposed Cache Creek project would provide flood control around the Clear Lake rim, sediment control on Lower Cache Creek, and wildlife enhancement.

1.04 Proposed plan. - The proposed plan consists of enlarging 3.3 miles of the existing 5-mile-long Clear Lake Outlet Channel, as shown on plate E-1 and described in Section E, and constructing a 1.1-mile-long channel to bypass the developed portion of the outlet channel. The plan would increase channel capacity to 8,000 cubic feet per second (cfs) with the lake level at 7.56 feet on the Rumsey gage at Lakeport (1326.21 feet, m.s.l. datum). In addition, the plan would also require future development to continue to flood proof to the preproject 100-year Clear Lake stage of 11.85 feet on the Rumsey gage. The plan

also includes increasing the capacity of the existing downstream Cache Creek Settling Basin, removing 50,000 cubic yards of deposited sediment annually, and establishing a wildlife refuge over the 3,600-acre basin. This portion of the plan is also described in Section E and shown on plate E-2.

1.05 Costs and benefits. - The costs and benefits for the outlet channel enlargement and the settling basin plans are summarized below:

Clear Lake Outlet Channel Enlargement and Bypass		
Total First Costs		$ 6,050,000
Annual Costs	$ 413,000	
Annual Benefits	1,205,900	
Benefit-Cost Ratio		2.9 to 1
Raise Settling Basin Levees with Wildlife Refuge		
Total First Costs		$11,910,000
Annual Costs	$ 966,000	
Annual Benefits	1,966,000	
Benefit-Cost Ratio		2.0 to 1

1.06 Relocation of utilities and residences. - The project would require the relocation of several residences along the outlet channel and within the settling basin. Relocation and modification of existing irrigation, drainage, and sewerlines will be accomplished as appropriate during construction of the project.

1.07 Compatibility with existing and proposed project. - The Yolo Bypass is a leveed floodway constructed by the Corps of Engineers as a part of the comprehensive flood control system for the Sacramento Valley. Cache Creek floodflows discharge into the bypass, and the

proposed plan would help preserve the integrity of this feature of the Sacramento River Flood Control Project. Other existing water resource developments in the basin include the Indian Valley dam and reservoir, which regulates flow in the North Fork of Cache Creek, and Clear Lake Dam, which regulates flows to Cache Creek from Clear Lake; both facilities are owned and operated by the Yolo County Flood Control and Water Conservation District. The Lakeport Lake project, which would be located 16 miles west of Lakeport on Scotts Creek, is authorized for construction by the Corps of Engineers to provide flood protection, municipal and industrial water supply, and recreation opportunities to the Scotts Creek Basin. Although enlargement of the Clear Lake Outlet Channel would have no flood control effect on the Lakeport Lake project, construction of Lakeport Lake would reduce flood stages on Clear Lake by up to 0.4 foot. The proposed plan does not conflict with any of these existing or proposed projects.

SECTION II - ENVIRONMENTAL SETTING WITHOUT THE PROJECT

2.01 Topography. - The topography of the Cache Creek Basin varies from steep and mountainous in the upper reaches to gently rolling foothills around the Capay Valley to a nearly level alluvial plain where the creek enters the Yolo Bypass. Elevations range from 20 to over 4,000 feet (B-4).

2.02 Geology. - The basin is underlain by the Franciscan formation which forms the core of much of the Coast Range. The highland areas are composed of consolidated sandstone, shale, and serpentinized basic intrusive rocks. The valleys are relatively flat alluvial areas underlain by sands and gravels. Extensive sand and gravel extraction operations occur in the Cache Creek Channel between Capay and Yolo (B-4).

2.03 Climate. - The climate of the Cache Creek Basin is the mild two-season Mediterranean type typical of California's Central Valley. Temperatures frequently exceed 100 degrees Fahrenheit in summer and occasionally fall below freezing during the winter months. Approximately 95 percent of the basin's mean annual rainfall of 35 inches occurs from October through April (B-5).

2.04 Hydrology and ground water. - Clear Lake is a shallow natural lake having a capacity of 315,000 acre-feet at zero on the Rumsey gage and

420,000 at 7.56 feet on the Rumsey gage. Average annual runoff of Cache Creek near Lower Lake is calculated to be 254,000 acre-feet. Approximately 96,000 acre-feet annually is being diverted from Cache Creek and used for irrigation mainly in the Lower Cache Creek area. The amount of water which can be depended upon (safe yield) is estimated to be only 46,000 acre-feet. Ground water is also extensively used for irrigation in the Lower Cache Creek area. Safe yields of ground water are estimated to be 200,000 acre-feet per year; however, present use is estimated to be 222,000 acre-feet per year (B-5, B-6, C-54).

2.05 Vegetation. - The plant communities identified in the project area are foothill-woodland, chaparral, valley grassland, riparian, and marsh. Along the Clear Lake Outlet Channel, residential development is scattered through riparian plant communities. Away from the riparian zone, stands of valley and live oak and open grasslands occur. Approximately 90 percent of the Cache Creek Settling Basin is under cultivation with the remaining 10 percent in sandbar willow (B-7 through B-9 and B-12, B-14).

2.06 Fish and wildlife. - The Clear Lake and Cache Creek areas support a diverse wildlife population. The State of California has rated Clear Lake as Class I - premium waterway and Cache Creek above the diversion dam as Class II - very good waterway for warmwater fisheries. Cache Creek below Capay is intermittent and supports minimal aquatic life. The State of California has indicated that Anderson Marsh, adjacent to

the Clear Lake Outlet Channel, is important in maintaining the biological productivity of Clear Lake. Wildlife inhabiting the proposed settling basin is similar to that on adjacent agricultural land. The southern bald eagle (Haliaeetus leucocephalus), American peregine falcon (Falco peregrinus anatum), and California yellow-billed cuckoo (Coccyzus americanus occidentalis), whose ranges include the Clear Lake and Cache Creek areas, are found on the Federal and State rare and endangered species lists. However, inclusion of these species on these lists does not indicate their presence within the project area but acknowledges their possible presence based upon distributional characteristics of each species (B-9 through B-13).

2.07 <u>Archeology and history</u>. - The Clear Lake area has been the site of human habitation for the past 10,000 years. The pleasant climate and abundant resources made it one of the most densely populated areas in the State. Trapping originally brought the Anglo-American into the Cache Creek Basin, but agriculture has been dominant in its more recent history (B-17 through B-20).

2.08 <u>Population</u>. - The project area encompasses two counties, Lake and Yolo. Lake County had a 1976 population of 27,600. Development in the county has occurred mainly around the Clear Lake rim where two-thirds of the county's permanent population resides. Yolo County had an estimated 1976 population of 104,700 persons. Woodland (population 25,150), located partially within the Cache Creek Basin, is the major population center (B-20 through B-30).

2.09 Land use. - Less than 45 percent of the land in the Clear Lake subbasin is privately owned. The remainder is held by the Federal Government, chiefly within the Mendocino National Forest. Agriculture and urban development, which comprise less than 10 percent of the land use, are generally concentrated in the areas near Clear Lake. Urban development is concentrated along the approximately 100 miles of lake shoreline. About 39 miles of this is developed for permanent and summer homes and for water-associated recreation.

Land use in the Cache Creek subbasin is mainly agricultural. Lands adjacent to and within Cache Creek channel are for the most part privately owned. The Bureau of Land Management administers some 23,000 acres in the mountainous upper portions of the basin.

Of the 3,600 acres within the Settling Basin, 90 percent is used for agriculture. However, agricultural productivity is constrained because of the present use of these lands for sediment retention. The levees and 20 feet of land on each side of the berm are owned in fee by the State of California with the remainder in easements (B-30 through B-33).

2.10 Socioeconomic conditions. - Both Lake and Yolo Counties are primarily rural. Clear Lake has long been one of Northern California's most important tourist and recreation attractions. In Lake County, recreation development continues to grow while the relative importance

of agriculture is being steadily eroded by the area's metamorphosis into a retirement and second home center. Yolo County is also undergoing major social and economic changes but continues to retain its rural orientation.

Agriculture in the Clear Lake subbasin is exceeded only by recreation in its contribution to the area's economy. In 1973 gross value of agricultural production reached $20 million. Over half of the area is cultivated in orchards, mainly pears and walnuts. Agriculture is the primary contributor to the economy of the Cache Creek subbasin. Total irrigated acreage in the Cache Creek area of Yolo County is estimated at 98,000 acres. Principal crops include orchards, alfalfa, sugar beets, rice, and tomatoes. Rice, corn, and tomatoes are grown in the Cache Creek Settling Basin.

Business in the Clear Lake subbasin is typically small and owner-operated, employing only a limited number of outside employees. In the resort area around the lake rim, strip development is the rule. There is little industry in the subbasin; the largest plants process and pack pears and walnuts. Businesses in the Cache Creek subbasin are centrally located in the Woodland area (B-41 through B-47).

2.11 Water quality. - Clear Lake has a high nutrient (phosphorus and nitrogen) content which encourages massive algal blooms during the spring and summer months. Although this eutrophication does not

interfere with agricultural use of the water, it does interfere with recreation by inhibiting shore activities when algae blow toward shore. The water quality of lower Cache Creek is considered satisfactory for irrigating crops. Use of the water is restricted, however, to those crops which are not sensitive to boron. Over 1 million cubic yards of sediment are discharged annually by Cache Creek into the Yolo Bypass, primarily in rain flood situations (B-15, C-40 through C-51 and C-55 through C-58).

2.12 Air quality. - The Clear Lake - Cache Creek Basin is located within the Sacramento Valley Air Basin. The mountainous boundaries of the air basin, coupled with light winds and atmospheric stability, make the basin highly favorable for the accumulation of air pollutants. The major air pollution problems in the Sacramento Basin are high concentrations of oxidant and suspended particulate matter. Both of these pollutants frequently exceed air quality standards, and the Sacramento Air Basin has been designated as a nonattainment area for oxidants (B-15 through B-17).

2.13 Future setting without the project. - In the absence of the proposed project, periodic flooding would continue to occur around the Clear Lake rim. Wildlife diversity should remain unchanged. Population and economic development would continue to grow around Clear Lake and in the urbanized areas of the Cache Creek Subbasin. As the settling basin fills, sediment from Cache Creek would continue to be deposited in the

Yolo Bypass and could eventually pose a flood threat to the Sacramento metropolitan area unless the sediment were removed or the bypass levees were raised.

SECTION III - RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

3.01 General. - The Land Use Element of the Lake County General Plan indicates that future land uses in the vicinity of the outlet channel would be suburban. This land use would not conflict with the proposed project as long as the project was constructed before the outlet channel area was further developed. The Open Space Element of the Yolo County General Plan indicates that the settling basin/wildlife refuge would be consistent with the goals of preserving agricultural use while conserving and renewing the natural resources of the county. The Conservation and Open Space Element of the Sacramento Regional General Plan encourages use of regulatory, management, and acquisition tools to achieve open space and natural resources protection. Consequently, it appears that the plan of development is in conformance with all of these General Plans. Some of the lands in the vicinity of the outlet channel have been zoned residential, but most lands are unclassified. Lands in the settling basin are zoned agricultural. Since Lake County is participating in the National Flood Insurance Program, all new structures along the Clear Lake rim are required to be flood proofed to the current 100-year flood elevation. The County plans to continue to flood proof to the preproject 100-year flood elevation.

The Soil Conservation Service is in the process of identifying all farmlands in the nation as to whether they are prime or unique. The

Service has not completed this task in the Cache Creek Basin. However, it does not appear that lands which would be occupied by project works would receive prime or unique status -- the farmland in the outlet channel is suitable only for grazing, and the farmland in the settling basin is subject to periodic inundation and associated sediment deposition.

The Clear Lake Dam is operated under two court decisions (Superior Courts of the State of California), the Gopcevic Decree and the Bemmerly Decree (Appendix 3). The Gopcevic Decree (1920) details the operation of the Clear Lake Dam and states that the then-named Yolo Water and Power Company is perpetually enjoined and restrained from excavating or deepening the Clear Lake Outlet Channel or widening, straightening, or otherwise interfering with the outlet. The Bemmerly Decree (1940) further restrains anyone from widening, deepening, or enlarging the Clear Lake Outlet Channel or increasing the flow of the outlet into Cache Creek. These two decrees would have to be modified before any alteration of the Clear Lake Outlet Channel.

SECTION IV - PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

4.01 Geology and seismicity. - The major factors assessed were the hazards imposed by site and regional geologic conditions on the safety of proposed project structures. Project features which could be affected by seismic activity would be designed to withstand maximum anticipated earthquake activity. The project would have no impact on mineral extraction along Cache Creek. If natural gas were discovered under the Cache Creek Settling Basin, little additional difficulty in extracting the resource would be experienced with the project.

4.02 Hydrology and flood control. - The deepening and widening of the Clear Lake Outlet Channel and construction of the bypass channel would provide a high degree of flood protection to the Clear Lake rim area. Normal flows of Seigler Creek will be siphoned under the bypass channel and thus would be unaffected by it. The increased peak flows will have negligible effect on Cache Creek below the diversion dam as gravel extraction operations have widened the channel downstream of Capay, increasing the channel capacity. The project will only affect flood-flows during which time gravel extraction operations would not be underway either with or without the project.

Enlargement of the levees at the sediment basin would provide 15,500 acre-feet of sediment storage, thus preventing 50 percent of the

Cache Creek sediment load from entering the Yolo Bypass and diminishing its capability as a floodway. Consequently, the threat of levee failure, with potential inundation of 100,000 acres, is reduced.

4.03 Vegetation. - Construction of the bypass channel and enlargement of the outlet channel would remove 71 acres of grassland, currently used as pasture, and 3 acres of riparian vegetation on the lower portion of the outlet channel below the point of connection with the bypass channel. However, the natural riparian vegetation of the bypassed oxbows would be undisturbed. Some of the vegetation would eventually reestablish, but how much and what kind would be permitted to reestablish would depend upon maintenance guidelines which would be designed to assure design channel capacity. Spoil from the construction would temporarily affect 80 acres of grassland. This area would be stabilized, replanted with native vegetation, and returned to its original use after a 5-year settling period. Riparian and oak-woodland vegetative types will be avoided in spoil placement. The Fish and Wildlife Service has indicated that operation of the bypass channel would have no impact on emergent and submergent vegetation in Anderson Marsh.

Construction of the plan of improvement in the Lower Basin would reduce agricultural production on approximately 3,600 acres and convert the basin to a sediment entrapment and removal operation and wildlife refuge with some continuing agricultural production. Approximately 250 acres

of this cropland would be permanently taken out of production for levee rights-of-way, and 260 acres would be temporarily disrupted for borrow material. In the areas where sediment is being periodically excavated, all vegetation would be removed. Refuge operations by the U.S. Fish and Wildlife Service will call for some or all of the land to be farmed on a crop-sharing basis, with the farmers growing only certain crops and leaving a portion of their harvest for wildlife. Mitigation measures for the habitat destroyed in the Clear Lake area include appropriately shaping lands and replanting vegetation on disturbed areas after construction. In addition, new riparian vegetation will be established along the 1.1-mile-long bypass channel.

4.04 Fish and wildlife. - Wildlife populations around the channel enlargement and bypass channel area would be temporarily displaced during construction. Wildlife populations would also be temporarily displaced from the dredged material disposal site. Aquatic productivity in the existing outlet channel would suffer a short-term loss due to blasting and dredging. The additional habitat being developed by construction of the bypass channel, including provision of fish habitat structures, would fully compensate for aquatic habitat losses. The channels would also be restocked with aquatic species following construction. The settling basin would be changed from a solely agricultural to an agricultural and wildlife habitat suited particularly to migratory waterfowl. The settling basin will be managed as a wildlife refuge with some continuing agricultural productivity, and the

habitat within the basin would be manipulated for the mutual benefit of wildlife and sediment removal. Proper operation of the refuge would reduce waterfowl crop depredation losses on lands surrounding the basin. The U.S. Fish and Wildlife Service, by letter dated 26 July 1977, indicated that it foresaw no need to recommend any land acquisition for mitigative purposes for proposed plans in upper or lower Cache Creek Basin. The project will have no discernable effect on any identified rare or endangered fish, wildlife, or plant species.

4.05 Archeology and history. - An intensive cultural resources survey of the proposed bypass channel and a reconnaissance level survey of the levee construction project were completed for the Corps in April 1977 by Sonoma State University in accordance with Section 106 of the National Historic Preservation Act and current regulations. No historic sites were discovered within the project area; however, 10 archeological sites were found which could be affected by the project within the Clear Lake to Clear Lake Dam area. Seven of these sites are in the Anderson Marsh Archeological District as listed in the National Register of Historic Places (44 FR 7430-6 Feb 1979). The specific limits of the sites are unknown at this time. If the project is authorized, a comprehensive cultural resources survey will be conducted and mitigative/protective measures recommended. At that time, the significance of any additional sites located within the project boundary will be considered under the National Register of Historic Places criteria. The California State Historic Preservation Officer (SHPO) concurred

with the recommendations of Sonoma State University to alleviate adverse impacts to cultural resources.

In accordance with 36 CFR 800 and 33 CFR 305 regulations, protective/mitigative measures for any affected archeological sites would be closely coordinated with the SHPO and the Advisory Council on Historic Preservation. Such measures could be one or a combination of the following:

- Avoid any damage through redesign of the project features, if feasible.

- Scientifically excavate and analyze all or part of the sites prior to construction.

- Arrange for a professional archeologist to be available during construction activities in the event that any presently unidentified sites are discovered.

Appropriate Native American organizations also would be advised of the project and its anticipated impact on cultural resources.

4.06 Land use. - Land use around the Clear Lake rim is not expected to change because of the project. Even though the 100-year flood level will be dropped 2 feet, the project will provide a high degree of flood protection because of continuation of existing zoning regulations. With this regulation, future development will be required to flood proof to at least the level of the preproject 100-year flood level.

Construction of the bypass and channel enlargement would change the land use on 71 acres from grassland to a flood control channel.

Another 80 acres will be utilized for spoil disposal. Present land uses will be eliminated in this area for approximately 5 years to allow for revegetation and settling of the soil.

Construction of the settling basin would reduce agricultural production on 3,600 acres of agricultural land. The land use would change to one of sediment removal and wildlife refuge with some continuing agricultural production, as described in paragraphs 4.03 and 4.04. Approximately 250 acres would be converted from cropland to levee. Private hunting clubs in the settling basin would be abolished. Since the need for annual excavation of sediment from the ship channels would be reduced by approximately 240 acre-feet, the need for land disposal areas for this material would be reduced. An opportunity exists to improve the quality of nearby farmland by application of sediment deposited in the settling basin.

4.07. Socioeconomic conditions. - Socioeconomic conditions would remain essentially unchanged from the existing conditions. The State of California has indicated that 3 residences in the settling basin would require relocation and 10 residences along Cache Creek and the new channel would require relocation. These relocations will affect about 33 people. These families would qualify for assistance under the Uniform Relocations Act. Numerous boat docks and piers would need to be temporarily removed or relocated during construction, causing an inconvenience. Residents near the construction areas may be disturbed

by minor increased noise levels during construction. Socioeconomic conditions around the Clear Lake rim and the outlet channel would be benefited by decreased chance of flooding of existing structures. Flood plain property values would be increased, and there would be a long-term stabilizing effect on housing. The dislocation of people due to flooding would be reduced, and health hazards associated with flooding would be decreased. Flood fighting costs and the flood threat to roads would be reduced. Transportation efficiency would be temporarily affected by reconstruction of bridges. Although recreation businesses along the outlet channel would be temporarily disrupted during construction, there would be a long-term stabilizing effect on recreation because of decreased flooding potential. Approximately 21 local workers would be hired for the 1.5-year construction period, and there would be an increase in maintenance personnel following project completion. Retail sales are expected to increase by $480,000 during construction; however, 79 acres generating about $6,800 in taxes annually would be removed from the tax rolls. Safety hazards during construction would be minimized because the most densely populated portion of the outlet channel would be bypassed. In the settling basin, agricultural production on 3,600 acres of farmland would be reduced. Approximately 90 local workers would be hired for the 2-year construction period, and a refuge management staff would be needed following project completion. Retail sales would increase a total of $1,050,000 during construction, and additional increases would accrue due to refuge and annual sediment removal operation. Increased revenue

of between $8,000 and $10,000 would accrue to Yolo County because lands would be taken for a National Wildlife Refuge, but tax revenues would be decreased by $90,000 annually. An additional 46,000 recreation days of hunter use would occur. There is a potential decrease in nearby road construction costs because of the availability of inexpensive fill material.

4.08 Water quality. - Water quality, principally turbidity parameters, would be temporarily affected by construction activities; however, these would be of short duration. With the resultant higher sustained outflow into Cache Creek during flooding, no additional erosion is expected (E-3). No improvement in the Clear Lake algal problem would accrue because of the project. The incidences of contamination of local water supplies due to flooding would be reduced. Because 335 acre-feet of sediment annually would not be discharged into the Yolo Bypass and the ship channels, turbidity would be reduced. Mitigation measures to reduce impacts on water quality include minimum vegetation clearing, reseeding, and replanting of scarred construction areas. A separate water quality evaluation was accomplished pursuant to Section 404 of the Clean Water Act (33 USC 1344), as amended. That evaluation, Appendix 5, indicates that study and evaluation of water quality factors accomplished during feasibility level planning determined that, since dredged or fill material would not be placed into waters of the United States, water quality would not be affected.

4.09 Air quality. - During construction of the proposed project, construction equipment and employee vehicles would cause some dust and vehicular emissions. The provisions for a wildlife refuge at the settling basin would result in an increase in vehicular use. Vehicle use of the wildlife refuge is expected to be the primary emission source generated by the project. These emissions would be insignificant among overall emissions but would be added to an area which is already high in vehicular emissions and has been designated as a nonattainment area for oxidants. Estimates of these pollutants as a percentage of future pollutants are summarized below. Emissions are projected for ultimate use of the project (year 50), based on miles traveled to and from the proposed wildlife refuge, and are computed using methods obtained from the California State Air Resources Board.

Emission (ton/year)	Nox	CO	HC
Project induced	6.53	24.34	3.84
County total	5,110	46,625	16,060
Percent induced by project	.128	.052	.024
Air Basin	77,745	762,850	209,145
Percent induced by project	.008	.003	.002

During the construction period, dust and other construction pollutant emissions would be regulated through enforcement of standard Corps of Engineers contract requirements.

4.10 Esthetics. - The esthetics of the Clear Lake area will be affected slightly by the bypass channel. The area will be visible from Highway 53 and from areas in Clear Lake Highlands. The spoil disposal area will

be visible to few people; consequently, its esthetic effect will be minor and temporary. Adverse effects from sediment removal operations in the settling basin should be balanced by increased vegetation via management for wildlife uses as well as continued agricultural production. Esthetic loss in the bypass channel area would be minimized by permitting scenic oxbows to remain and by creating potentially scenic new riparian areas. In the settling basin, the area would be restored to a relatively natural state, thereby having long-term esthetic impact. The annual sediment excavation feature reduces demand for fill material from other areas and reduces amount of land scarring outside of the settling basin.

SECTION V - PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

5.01 General. - Approximately 71 acres of grassland, 3 acres of riparian forest, and 250 acres of agricultural land would be occupied by project features. Agricultural production would be reduced on 3,350 additional acres being converted into a wildlife refuge. Thirteen residences have been identified for relocation, and lands generating $96,800 in taxes would be removed from the tax rolls. Temporary impacts would accrue to resident fish and wildlife, water quality, air quality, and esthetics but would be mitigated. No additional adverse impacts will result from the proposed project since the mitigative measures discussed in Section IV would be implemented and standard Corps of Engineer specifications for environmental protection and control of contractor operations would be followed.

6.01 General. - As discussed in Section D of the feasibility report, 19 alternative plans were considered in developing the selected plan. However, many of these plans were eliminated from further consideration because of limited economic feasibility, significant environmental problems, limited potential for providing long-term solutions, or serious consideration of that solution by other agencies. The following list displays the 19 alternative plans, with those alternatives considered in greater detail signified with an asterisk:

UPPER BASIN (Clear Lake)

* Plan 1 - No action

Plan 2 - Flood forecasting

Plan 3 - Evacuation of the flood plain

Plan 4 - Flood proofing existing facilities

* Plan 5 - Flood proofing future facilities

Plan 6 - Reservoir storage on tributaries

Plan 7 - Modify operation of Clear Lake for flood control

* Plan 8 - Clear Lake Outlet Channel enlargement

* Plan 9 - Clear Lake Outlet Channel enlargement and bypass

* Plan 10 - Clear Lake Outlet Channel enlargement and modified bypass

LOWER BASIN (Cache Creek)

* Plan 11 - No action

Plan 12 - Nonstructural alternatives

* Plan 13 - Raise Settling Basin levees

* Plan 14 - Raise Settling Basin levees with wildlife refuge

Plan 15 - Excavate Settling Basin

Plan 16 - New North Settling Basin

Plan 17 - New South Settling Basin

Plan 18 - Kellner Jetty System

Plan 19 - Brooks Sediment Reservoir

The following paragraphs discuss the environmental impact of the alternatives considered in detail:

6.02 Upper Basin - No action. - See page D-33 for description of this alternative. This alternative would result in continued substantial flooding causing major damage to housing units, utilities, roads, and sewerage systems. However, no conversion of land use would occur as it would in the selected plan or with the other alternatives.

6.03 Upper Basin - Flood proofing future facilities. - With this alternative, a requirement would be added to existing land use regulations for all future development to be flood proofed to the level of the Standard Project Flood. For further information on this alternative, see page D-34. With this plan, increased costs of flood proofing would discourage development in the Standard Project flood plain, thereby assisting in preserving the remaining environmental

values of the Clear Lake rim. However, this plan provides no measure of flood protection to existing development, and the impact of this alternative on the existing development would be similar to the "no action" plan.

6.04 Upper Basin - Clear Lake Outlet Channel enlargement. - This alternative consists of enlarging the Clear Lake Outlet Channel to obtain a capacity of 8,000 cfs (D-39).

Excavating and reshaping the Clear Lake Outlet Channel would remove about 7 acres of riparian vegetation. Some vegetation would eventually reestablish, but the extent would depend upon the nature and frequency of channel maintenance. Fish populations would probably be disturbed during channel improvement work because an appreciable amount of blasting would be required to excavate the channel. Water quality, principally turbidity parameters, would be temporarily impaired by the construction activities. Eighteen homes would be removed and numerous boat docks and marinas would need to be temporarily removed or relocated. Two bridges would be reconstructed but detours would be provided. Eighty acres of grassland would be temporarily utilized for spoil disposal. Recreation use would be temporarily reduced with a resultant loss of recreation revenue during the construction period. Air quality may be slightly reduced by the heavy equipment required for construction activities. Residents near the construction areas as well as the local wildlife population may be disturbed by the high noise

levels associated with the heavy equipment during the construction period. Esthetics in the spoil disposal areas would be degraded until new vegetation is established.

6.05 Upper Basin - Clear Lake Outlet Channel enlargement and modified bypass. - This alternative, discussed on page D-43, is nearly identical to the selected plan except that the bypass channel would follow a meandering alignment to enhance the fishery and create additional riparian habitat. The adjacent 560-acre Anderson Marsh would also be purchased to preserve it from further development. The environmental impacts would be similar to those of the selected plan, but considerable environmental benefits would occur with implementation of the modified features.

6.06 Lower Basin - No action. - See page D-45 for a discussion of this alternative. The existing Cache Creek Settling Basin is at capacity, and continued use would result in the annual average of 1.2 million cubic yards of sediment transported by Cache Creek being deposited into the Yolo Bypass, downstream navigation channels, and San Francisco Bay. Backwater effects caused by deposited sediment would eventually necessitate raising levees along the Yolo Bypass, the Knights Landing Ridge Cut, and along the Sacramento River to maintain freeboard standards on these portions of the Sacramento River Flood Control Project. Extensive modification of remaining riparian vegetation would result from this levee raising. There would be no significant change in air quality with this alternative.

6.07 Lower Basin - Raise Settling Basin levees. - This alternative consists of raising the levees of the sediment basin to accommodate additional sediment (D-47). The raising and enlarging of the settling basin levees would require 260 acres to serve as borrow areas for the enlarged levees. This borrow material would come from inside the settling basin. The vegetation on the borrow area sites, primarily irrigated crops, would be removed, and vegetation on the existing levees, primarily grasses, would also be removed; this vegetation could later be replanted. This alternative would cause a very slight decrease in air quality, primarily associated with recreation use of the proposed waterfowl refuge in the settling basin.

SECTION VII - THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.01 Clear Lake Subbasin. - The flood protection work described herein would supplement the flood plain zoning implemented recently around the rim of Clear Lake. The construction project would remove a small amount of riparian vegetation habitat but would help insure the continued long-term existence of the remainder against the encroachment of development. Implementation of the proposed plan would insure the long-term productivity of the lake rim by preventing future floods from damaging homes, recreation areas, wildlife habitat, and other areas utilized by man and wildlife. The beneficial effect of occasional flooding of wildlife habitat along Clear Lake rim would be insignificantly lessened. Except during flood stages along the lake rim, the lake would be operated in the same manner as it is currently being operated. In the long run, beneficial use of the lake by man would increase because of the reduction of the flood threat. Numbers of fish and wildlife may be reduced temporarily (short-term) in the construction area but would eventually return to numbers that would exist on the site without the project.

7.02 Lower Cache Creek. - Construction of the settling basin as described herein would reduce the deposition of sediment in the Sacramento River Flood Control System's Yolo Bypass, the Sacramento Deep Water Ship Channel, and San Francisco Bay. Failure to implement such a

long-term solution will require eventually that extensive short-term measures be implemented at non-Federal expense to continue effective operation of the Sacramento River Flood Control System and prevent significant flood damages. The project would temporarily displace wildlife in the settling basin but would, in the long run, provide a habitat for a greatly increased and diversified wildlife population. The existing vegetation in the settling basin (mostly annual grasses and irrigated crops) would be removed for sediment excavation but would be replaced with higher value vegetative species, with some continuing agricultural production, and managed for wildlife habitat (long-term). Use of the settling basin as proposed would reduce agricultural cultivation over the long term as a source of food for man.

SECTION VIII - IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

8.01 General. - Irreversible commitments of resources for this project would be the removal of pastureland, which would be used for the bypass of the Clear Lake Outlet Channel, removal of some riparian habitat along the outlet channel, and removal of a few residences and docks. Implementation of the wildlife refuge concept for the settling basin would reduce agricultural uses. However, the settling basin could be brought back into full agricultural productivity at any time if required, but this would be at the expense of the wildlife refuge. Lands utilized in levee construction would be irretrievably lost. Energy and labor resources expended during construction and operation are permanently committed to the project. There would be no commitment to future development of resources because of the project either along the Clear Lake rim or downstream of Clear Lake Dam.

CACHE CREEK BASIN, CALIFORNIA

FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT
FOR WATER RESOURCES DEVELOPMENT

LAKE AND YOLO COUNTIES, CALIFORNIA

APPENDIX 5

Section 404 Evaluation Report

PREPARED BY THE
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

APPENDIX 5 - SECTION 404 EVALUATION REPORT
CACHE CREEK BASIN, CALIFORNIA

1. In accordance with Section 404 of the Clean Water Act (33 USC 1344), as amended, and other pertinent laws and regulations, the placement of dredged or fill material into waters of the United States or their associated wetlands requires an evaluation of water quality considerations associated with the action. The Cache Creek Basin Investigation indicates a need for placement of dredged or fill material in connection with modification of the Clear Lake Outlet Channel in upper Cache Creek Basin and modification of the Cache Creek Settling Basin and creation of a National Wildlife Refuge in lower Cache Creek Basin. However, since material will be placed outside of any waters of the United States or their adjacent wetlands (on approximately 80 acres of grassland in upper Cache Creek Basin and 250 acres of cropland in the Cache Creek Settling Basin), water quality and wetlands would not be affected by placement of dredged or fill material from project construction.

2. The following tabulation identifies (a) pertinent environmental factors considered for the Cache Creek Basin Investigation under Section 404 of the Clean Water Act of 1977, (b) referenced paragraphs of documents in which the factors are analyzed or discussed, and (c) remarks.

3. The following public involvement and coordination activities were conducted during the Cache Creek Basin Investigation.

a. Public Notices: In November 1975 and February 1978 information brochures were prepared and made available to the public, summarizing the flood and sediment control problems in the study area, alternatives considered, advantages and disadvantages of each alternative, and the status of the investigation. A public notice will be issued by the Division Engineer upon his transmittal of this feasibility report to the Chief of Engineers; this notice will include an invitation to the public to review and comment on all aspects of the project, including water quality related data. The Board of Engineers for Rivers and Harbors (BERH) will conduct a review of the proposed project. The BERH review will be followed by subsequent reviews by the Office of the Chief of Engineers, the Office of the Secretary of the Army, the Office of Management and Budget, and by Congressional consideration. During all of these review phases, public input is encouraged on all project aspects.

b. Public Meetings: Public meetings were held on 2 July 1969, 2 and 4 December 1975, and 20 and 21 March 1978 to afford interested parties and the general public an opportunity to express their views. Project alternatives were discussed and the interests and concerns of the public were noted.

c. Environmental impact coordination: An environmental working paper (a predraft environmental statement) was distributed for informal review and comment in June 1975. The working paper identified environmental impacts of the alternatives and was informally transmitted to Federal, State, and local agencies, organizations, and individuals. Comments obtained were incorporated into the draft environmental

statement. The draft environmental statement was transmitted for formal public review and comment concurrently with the draft feasibility report. Water quality and other Section 404 permit-related factors comprise important sections of that report.

d. Other coordination: During this investigation, advice and comments have been requested and received from agencies having primary responsibilities for specific problem areas. These agencies included the Environmental Protection Agency, Fish and Wildlife Service, California Water Resources Control Board, California Department of Water Resources, California Department of Fish and Game, and others. This input has been incorporated into the proposed project.

4. Based on studies conducted during the feasibility investigation, environmental factors pertinent to the Section 404 evaluation process have been considered. Prior to construction, additional, more detailed studies of environmental factors pertinent to the Section 404 evaluation process would be conducted during the advanced planning and design phases.

REFERENCE LIST FOR SECTION 404 EVALUATION

FACTOR CONSIDERED	REFERENCE	REMARKS
Water quality	Revised Draft EIS, paragraph 4.08 Main Report, pages B-15, C-40 through C-51 and C-55 through C-58	No additional analyses/studies required
Air quality	Revised Draft EIS, paragraph 4.09 Main Report, pages B-15 and B-17	No additional analyses/studies required
Hydrology	Revised Draft EIS, paragraph 4.02 Main Report, pages B-5, B-6 and C-54	No additional analyses/studies required
Vegetation	Revised Draft EIS, paragraph 4.03 Main Report, pages B-7 through B-9	No additional analyses/studies required
Fish and wildlife	Revised Draft EIS, paragraph 4.04 Main Report, pages B-9 through B-15 Fish and Wildlife Service Detailed Report on effect of proposed actions on fish and wildlife resources	No additional analyses/studies required
Cultural resources	Revised Draft EIS, paragraph 4.05 Main Report, pages B-17 through B-19 Fredrickson, D.A. and J. Parker, "An Archaeological Survey of the Cache Creek Basin Project, Lake County, California," April 1977	More detailed studies required following project authorization to satisfy requirement of 36 CFR 800
Esthetics	Revised Draft EIS, paragraph 4.10	No additional analyses/studies required
Endangered, threatened, and rare plants and animals	Revised Draft EIS, paragraph 4.04 Main Report, pages B-12 through B-15	No additional analyses/studies required

CACHE CREEK BASIN, CALIFORNIA

FEASIBILITY REPORT AND ENVIRONMENTAL STATEMENT
FOR WATER RESOURCES DEVELOPMENT

LAKE AND YOLO COUNTIES, CALIFORNIA

Reports/Correspondence From Others

APPENDIX 6

PREPARED BY THE
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

REPORTS/CORRESPONDENCE FROM OTHERS

TABLE OF CONTENTS

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
~~BUREAU OF SPORT FISHERIES AND WILDLIFE~~

1500 N. E. IRVING STREET
P. O. BOX 3737
PORTLAND, OREGON 97208

June 16, 1975

F. G. Rockwell, Jr.
Colonel, CE
Department of the Army
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel Rockwell:

This is in reply to your well-written letter concerning the possibility of establishing a National Wildlife Refuge as part of the proposed Cache Creek Settling Basin Project.

The Fish and Wildlife Service is interested in the possibility of incorporating a migratory waterfowl refuge into this proposal, as outlined in your letter of May 13, 1975. Migratory bird land acquisition objectives call for additional refuges and wetland preservation in the Central Valley of California. This project would thus help meet these objectives. As planning continues and if the refuge scheme is determined to be the best alternative, we can then present this project to our Washington Office for formal approval from the Department of Interior.

We visualize this proposal would be similar to the Sutter National Wildlife Refuge in operation and benefits, as all or portions of this refuge are usually inundated annually. The following information relating to the Cache Creek Project is based on costs and benefits from this existing refuge:

Estimated Annual Operation and Maintenance Cost - $40,000

Estimated Refuge Benefits and Uses

Peak Waterfowl Numbers:	150,000 ducks	15,000 geese
Annual Use-Days:	7,000,000 ducks	300,000 geese
Annual Use-Days by Other Migratory Water Birds:	400,000	

Crop Depredation Prevention, $ Saved per Year $75,000

Public Uses:

Hunting	8,000 Activity Hours Annually
Wildlife Observation and Photography	4,000 Activity Hours Annually
Environmental Education	800 Activity Hours Annually

This proposed project would also benefit or improve waterfowl distribution in the Central Valley. Improved distribution would likely decrease waterfowl disease loss and crop depredation and increase off refuge public uses (hunting and wildlife observation). This proposed refuge would be administered under the Sacramento National Wildlife Refuge Complex headquarters near Willows.

Please contact Dick Bauer (503-234-3361 x 4071) if additional information or explanation is needed.

Sincerely yours,

R. Kahler Martinson

R. Kahler Martinson
Regional Director

Edmund G. Brown Jr.
[redacted] Governor

STATE OF CALIFORNIA—RESOURCES AGENCY

DEPARTMENT OF FISH AND GAME
1416 NINTH STREET
SACRAMENTO, CALIFORNIA 95814

(916) 445-3531

August 21, 1975

Colonel F. G. Rockwell, Jr.
District Engineer, Sacramento District
U.S. Army Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Colonel Rockwell:

Thank you for the opportunity to present our comments on the proposal concerning the operation of a wildlife area in conjunction with the Cache Creek Settling Basin project.

We feel the area has a great deal of potential as a wildlife area and could be managed to provide benefits to both wildlife and the public.

The Department is interested in operating the area as a unit to our Gray Lodge Wildlife Area. However, until the separable cost data is available, the Department cannot make a commitment.

In respect to the other information you requested we have the following to offer:

If the area was operated as a unit of our Gray Lodge Wildlife Area, maintenance and operation costs are estimated to be $100,000 annually. Waterfowl and shorebirds would benefit the greatest. Habitat development could increase resident populations of game and nongame species. There would also be benefits derived due to alleviating crop depredations.

It is our belief that an increase in waterfowl depredation will occur in this general area due to the relaxing of rice allotments and an increase of submarginal lands being planted to rice. These lands do not produce heavy stands, and have more open water which attracts waterfowl. Recreational values would include both consumptive and nonconsumptive uses. Waterfowl and upland game hunting would provide a minimum of 1,900 hunter use days annually. Fishing is expected to provide a minimum of 500 angler use days annually.

Bird watching and sightseeing use has not been estimated but would be high because of the area's close proximity to the City of Sacramento. Also there are many schools located within thirty minutes driving time, in both Yolo and

Sacramento counties which could utilize the area to provide an educational outdoor experience for children attending those schools.

Again thanks for requesting our input. In the event I can be of further assistance, please let me know.

Sincerely,

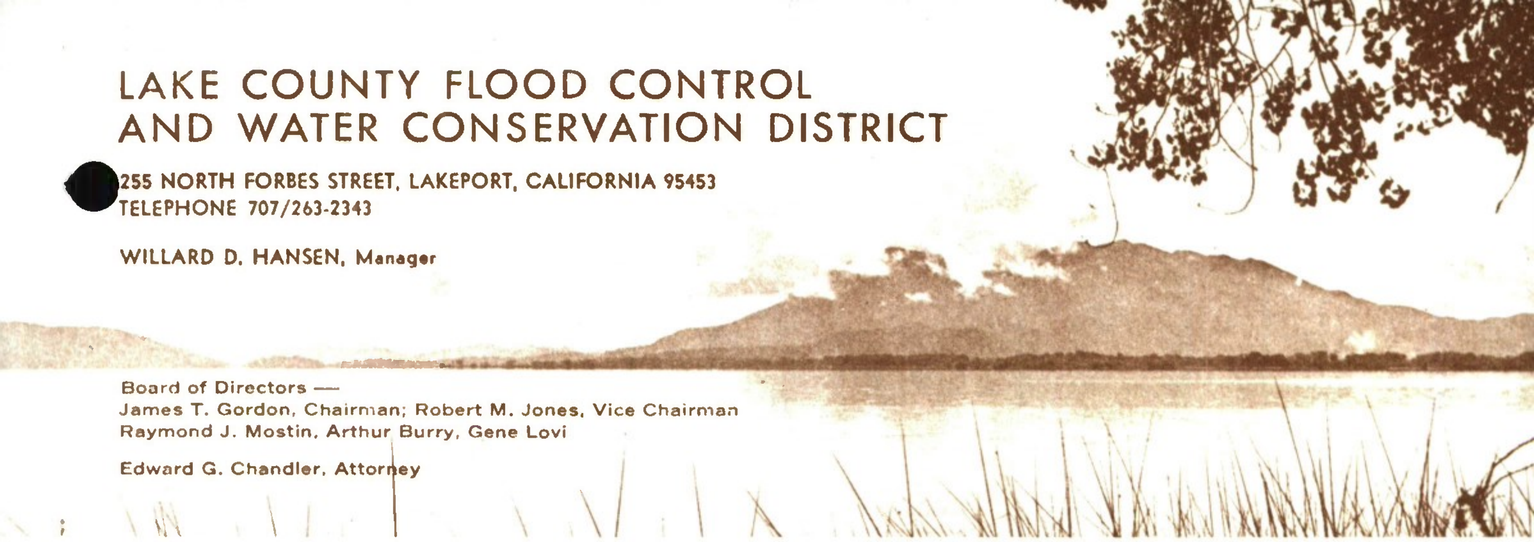
EC Fullerton

Director

LAKE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

255 NORTH FORBES STREET, LAKEPORT, CALIFORNIA 95453
TELEPHONE 707/263-2343

WILLARD D. HANSEN, Manager



July 11, 1977

Department of the Army
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

ATTENTION: George C. Weddell

Dear Mr. Weddell:

Please be advised that upon execution of an agreement between the Lake County Flood Control and Water Conservation District, the Yolo County Flood Control and Water Conservation District, and the Department of the Army, Corps of Engineers to enlarge the Clear Lake outlet channel and operate the Clear Lake dam for flood control purposes of the Cache Creek Basin, the Lake County Flood Control and Water Conservation District will seek appropriate amendments to those certain judgments in <u>Gopcevic et. al.</u> v <u>Yolo Water and Power Company et. al.</u>, and <u>Bemmerly</u> v <u>Clear Lake Water Company et. al.</u> which would allow the agreed upon modifications and operation.

Very truly yours,

James T. Gordon

JAMES T. GORDON, Chairman
Board of Directors

ATTEST: LOIS R. HESTERBERG
County Clerk

By Norma M. Thrasher
Deputy

Appendix 6

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
2800 Cottage Way, Room E-2727
Sacramento, California 95825

July 26, 1977

District Engineer
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Sir:

This letter sets forth our preliminary views on certain aspects of the Cache Creek Flood Control Project, Lake and Yolo Counties, California. The letter is intended as an aid in the overall planning process and is not our detailed report as provided for under the Fish and Wildlife Coordination Act. The following comments, provided in response to a verbal request from members of your staff, have been informally coordinated with the California Department of Fish and Game. As explained to your staff, completion of our detailed report has been delayed due to a change in personnel at this office and to the time required to coordinate and process our habitat evaluation procedures (HEP). We hope to complete the draft of our final report by mid-September.

From our analysis of the project thus far, we have two major concerns that may require mitigative measures. The first of these is the loss and degradation of aquatic and riparian habitat along the outlet channel at Clear Lake. The opportunity exists to adequately offset these impacts by implementing the following measures: (1) redesign of the easternmost spoil site so that no spoil is placed in the large riparian area adjacent to the creek, (2) replacement of riparian vegetation due to construction by planting in cleared areas and along the new bypass channel, and (3) management of the riparian lands in a manner favorable to fish and wildlife. Our second major concern relates to project-induced developments expected to follow the lowering of the 100-year flood level. As you know, the reduction of flood threat usually fosters increased construction in previously flood prone areas with resultant losses to fish and wildlife habitat. In this particular case, we understand that as part of this project Lake County has agreed to maintain, through zoning, restrictions on construction below the present 11.6-foot level on the Rumsey gauge even though the new 100-year flood level would be below that elevation. If this is in fact the case, we do not foresee that development pressures in the area below 11.6-feet on the Rumsey

gauge would differ under with or without the project conditions and no mitigation would be required.

We envision that our detailed report will deal with these matters essentially as discussed above. Based on our analysis to date, we do not foresee the need to recommend any land acquisition for mitigative purposes.

Sincerely,

James W. Carson

for Felix E. Smith
Field Supervisor

cc: ARD-Env. (ES), FWS, Portland
AM, Sacramento

STATE OF CALIFORNIA—THE RESOURCES AGENCY EDMUND G. BROWN JR., Governor

DEPARTMENT OF PARKS AND RECREATION
P.O. BOX 2390
SACRAMENTO 95811
(916) 445-8006

November 4, 1977

Donald M. O'Shei
Colonel, C.E.
District Engineer
U.S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel O'Shei:

An Archeological Survey of the Cache Creek
Basin Project, Lake County

My staff has reviewed the archeological survey report compiled for the undertaking referenced above.

We were impressed by the professional quality of this report and we support Dr. Fredrickson's recommended procedures to alleviate the adverse impacts from those cultural resources located within the project's area of potential environmental impact.

Our only suggestion, at this time, is that you should solicit input from the Native American community in regards to their concerns over the area's Native American archeological sites. We agree with Dr. Fredrickson, that the recorded cultural resources: CA-LAK-30, CA-LAK-69, CA-LAK-384, CA-LAK-386, CA-LAK-541, CA-LAK-625, CA-LAK-635, CA-LAK-880, CA-LAK-881, and CA-LAK-882, are eligible for inclusion on the National Register of Historic Places. I look forward to your request for a determination of eligibility per 36 CFR Part 63. You are therefore reminded that, in compliance with Executive Order 11593, jurisdiction over the lands included in this project includes the responsibility to preserve and enhance these cultural resources. We will appreciate being kept up-to-date on the progress of this project and receiving all subsequent cultural resource assessment reports compiled for this area's cultural resources.

If we can be of further assistance in this matter, please feel free to contact William Seidel at (916) 322-8702.

Sincerely yours,

Dr. Knox Mellon
State Historic Preservation Officer

G-2611A

COUNTY OF YOLO

Woodland, California

95695

BOARD OF SUPERVISORS
916-666-8407

August 29, 1978

Colonel Donald M. O'Shei
District Engineer
Sacramento District
Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel O'Shei:

By letter dated March 20, 1978, the Yolo County Flood Control and Water Conservation District provided comments to you on the draft feasibility report and EIS for the Cache Creek Basin Investigation. In that letter, they stated their agreement with the Corp's final choice of alternatives with respect to resolution of the flood problem on Clear Lake and sediment problem in Lower Cache Creek Basin. As you are aware, the proposed plans involve enlargement of the Clear Lake Outlet Channel in Lake County and modification of the existing Cache Creek Settling Basin here in Yolo County. At this time, the Yolo County Board of Supervisors would like to also voice our support for the proposed plans subject to the conditions outlined in Minute Order No. 78-650.

We concur that enlargement of the Clear Lake Outlet Channel will require modification of the 1920 Bemmerly and 1940 Gopcevic Court Decrees. Accordingly, we intend to work toward modification of these decrees at the appropriate time, as necessary to allow implementation of the plans as proposed.

Sincerely,

WILLIAM E. DUNCAN, Vice-Chairman
Yolo County Board of Supervisors

WED:wls

cc: Clerk of the Board, Planning, Public Works, County Administrator, and County Counsel
Lake County
Capay Valley Water Users Association
Yolo County Flood Control and Water Conservation District

MINUTE ORDER NO. 78-650: Approved by the Board of Supervisors on August 29, 1978

Took the following actions regarding the Cache Creek Basin Corps of Engineers' proposal:

1. Yolo County Board of Supervisors comments favorably on the Cache Creek Settling Basin Project, which is the lower end of the Cache Creek.

2. Yolo County Board of Supervisors withheld comments on the Upper Outlet Project at this time, until further study by the Corps and by some agreement to satisfy the concerns of the landowners and the Capay Valley Water Users Association along Cache Creek, who will be affected by this project.

3. Yolo County Board of Supervisors supports the concept but wants further studies made, and to focus specific attention to provide ways to mitigate the erosion problems if they arise.

4. Directed the Vice-Chairman of the Board of Supervisors to sign a Letter of Intent, prepared by the County Counsel and County Administrative Officer, incorporating parts of the Minute Order.

5. Instructed copies of the letter to be sent to Lake County Board of Supervisors and to Sheldon Wyatt, representing the Capay Valley Water Users Association.

GPO 689-055/083

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

CACHE CREEK BASIN

CALIFORNIA

A DETAILED REPORT ON FISH AND WILDLIFE RESOURCES

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Area Office
2800 Cottage Way, Room E-2740
Sacramento, California 95825

AUG 1 1978

In Reply Refer To: ES-S

District Engineer
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Sir:

This is our detailed report on fish and wildlife resources in relation to your plan of development for the flood control improvements at Clear Lake and sediment control improvements at Cache Creek Settling Basin, Lake and Yolo Counties, California. Construction of the project has not been authorized by the Congress.

The report discusses the effects of the project on fish and wildlife resources and contains our recommendations for their conservation and development. It has been prepared under the authority, and in accordance with the provisions, of the Fish and Wildlife Coordination Act (48 Stat. 401 as amended; 16 U.S.C. 661 et seq.). In addition, it has been endorsed by the California Department of Fish and Game as signified by the appended letter of July 3, 1978, signed by Director E. C. Fullerton.

The plan of development proposed by the Corps of Engineers includes the establishment of a National Wildlife Refuge at the Cache Creek Settling Basin. The Fish and Wildlife Service supports the Corps of Engineers' development plan, contingent upon the adoption of the following recommendations:

1. Coordinate post-authorization planning for the replacement of riparian habitat along the outlet channel, and for the establishment of riparian vegetation along the bypass channel, with the California Department of Fish and Game and the Fish and Wildlife Service.

2. Provide for fish habitat improvement in the outlet channel, and in the bypass channel, by the excavation of potholes in the channel bottoms; placement of large boulders and whole anchored trees in the channels; and excavation of nesting cavities for catfish in the channel walls.

3. Provide for a flow in the reach of Seigler Canyon Creek between the bypass channel and the outlet channel sufficient to maintain the existing riparian vegetation.

This report is based on: (1) planning information provided by the Corps of Engineers prior to July 1978; (2) the current status of existing resources; and (3) projection of futures using current information and techniques. Therefore, appropriate revisions may be necessary in the event of significant changes in project plans; if the resource base has changed; or if anticipated futures are altered.

Please notify us of your actions regarding our recommendations.

Sincerely yours,

William D. Sweeney

Area Manager

Attachments

STATE OF CALIFORNIA—RESOURCES AGENCY EDMUND G. BROWN JR., Governor

DEPARTMENT OF FISH AND GAME
141[illegible]NTH STREET
SAC[illegible]ENTO, CALIFORNIA 95814
(916) 445-3531

July 3, 1978

Mr. William D. Sweeney
Area Manager
U. S. Fish & Wildlife Service
2800 Cottage Way, Room E-2740
Sacramento, California 95825

Dear ~~Mr. Sweeney~~: Bill

We have reviewed your draft report of the effects on fish and wildlife of the Cache Creek project in Lake and Yolo Counties. This draft satisfactorily addresses our concerns about the earlier draft. We concur with your assessment of the impacts of the project on fish and wildlife.

We would like to have several copies of the final version of this report.

Thank you for the opportunity to review and for including our comments in your report.

Sincerely,

Director

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Area Office
Sacramento, California

A DETAILED REPORT

on the

CACHE CREEK BASIN

July 1978

TABLE OF CONTENTS

PREFACE

This is a detailed report of the impacts on fish and wildlife resources associated with the proposed construction of flood control improvements at Clear Lake and sediment control improvements at Cache Creek Settling Basin, Lake and Yolo Counties, California. The feasibility report of the Corps of Engineers is being prepared in response to a resolution by the Committee on Flood Control of the House of Representatives, dated May 26, 1946, and a resolution by the Committee on Public Works of the House of Representatives, dated June 19, 1963. The Fish and Wildlife Service has been consulted throughout the planning process and has had input into selection of the recommended alternative considered in this document.

The findings of this report are based on available data, field investigations, and surveys conducted according to the methods set forth in the Fish and Wildlife Service's Habitat Evaluation Procedures. These procedures provide a means to calculate an index of existing and future conditions. Characteristics of the community are appraised with respect to their value in providing the necessary habitat requirements for selected species. The habitat carrying capacity is displayed as Habitat Unit Values, an index of quality and quantity of the habitat being evaluated. The basic objective of these procedures is to quantify in nonmonetary terms the impacts of the plan and to provide a basis for determining the preservation, compensation and enhancement measures which are needed to maintain and improve the integrity of the ecosystem.

The analysis for the sediment control part of the project at Cache Creek Settling Basin is based on a project life of 50 years and that for the flood control part, Clear Lake and Cache Creek, on 100 years. Both analysis periods begin in 1985.

This report was prepared by Fish and Wildlife Biologist Frank J. Michny, Jr., Division of Ecological Services, Sacramento, under the direction of Field Supervisor Felix E. Smith.

DESCRIPTION OF THE AREA

Cache Creek basin separates naturally into two hydrological areas: Clear Lake and its tributaries, and the downstream Cache Creek area comprised of Cache Creek and its tributaries.

Clear Lake is a 42,000-acre, irregularly shaped body of fresh water approximately 19 miles long and 7 miles wide. Clear Lake is relatively shallow with maximum depths of 30 feet in the upper end and 50 feet in the lower end. The lake discharges into Cache Creek via Clear Lake Outlet Channel and Clear Lake Dam at the lower end of the 5-mile long channel.

Agriculture is the predominant land use on the level lands surrounding Clear Lake. The lake supports an important tourist industry and therefore much of the lakefront has been modified by bulkheads, commercial developments, and dwellings, as illustrated in Figure 1. The shoreline of Clear Lake has been subject to flooding throughout its known history, a condition caused by the fact that the outlet channel does not accommodate inflow to the lake at all times. Although a dam exists at the lower end of the outlet channel, it does not control channel capacity during large flows. At such times impairment of flow is caused by a natural restriction upstream: Brigsby Riffle.

Figure 1. Development along the lakeshore resulting in loss of shallow water habitat.

From Clear Lake Dam, Cache Creek flows toward the southeast for 80 miles to Cache Creek Settling Basin from which its waters discharge over a weir into Yolo Bypass east of the city of Woodland. From Clear Lake Dam, the creek descends through rugged 30-mile long Cache Creek Canyon (shown in Figure 2) and then traverses the agricultural lands of Capay Valley and Sacramento Valley to reach the settling basin. Two major tributaries of Cache Creek, North Fork Cache Creek and Bear Creek, enter the mainstem in the canyon. In lower Capay Valley, diversion and distribution facilities consisting of two dams and a series of canals convey Cache Creek flows to irrigation service areas. During the irrigation season, the total flow of Cache Creek is diverted at Capay Dam. Adams Canal, which originates at Capay Dam, conveys water to Moore Dam located on Cache Creek 10 miles

downstream from Capay Dam. From Moore Dam water is redistributed to lands lying west of Woodland. There are several diversions of Cache Creek flows made above Capay Dam to service lands of upper Capay Valley. Agricultural lands along the reach of Cache Creek downstream from Rumsey experience occasional flooding. Damage to farmland also occurs when streambanks are eroded during high flows.

Figure 2. Cache Creek descending through Cache Creek Canyon.

Vegetative cover in the project area varies with slope, soil, exposure and elevation. A dense chaparral dominated by chamise, manzanita, and scrub oak probably occupies more of the drainage area than any other cover type. Oak and digger pine woodland occurs on many of the lower slopes in the drainage (Figure 3). Lands in the Cache Creek Canyon area are vegetated largely by chaparral and are used for grazing. With the exception of lands immediately adjacent to the creek, lands in the lower Cache Creek area from Capay Valley to the settling basin are used primarily for irrigated agriculture, including tilled crops and orchards. Lands within the 3,600-acre settling basin are also farmed. Marshes fringe parts of Clear Lake and occur in small stands along the outlet channel and tributaries of the lake. The largest marsh, shown in Figure 4, is known as Anderson Marsh and is located at the southern end of the lake near the upper end of the outlet channel.

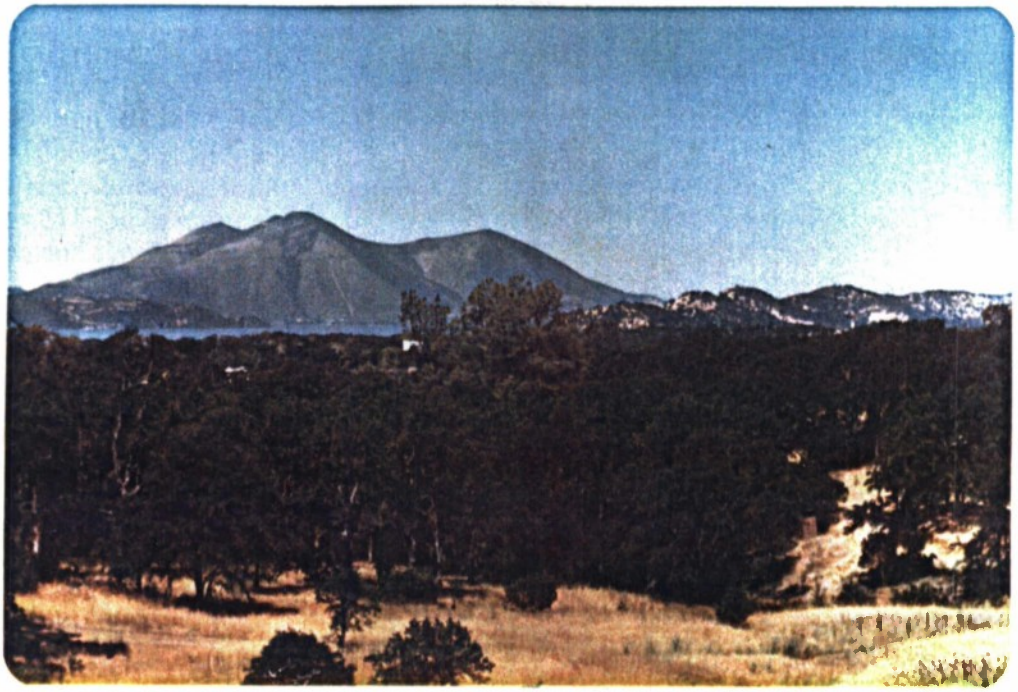


Figure 3. Clear Lake basin with chaparral covered mountains in background and oak and digger pine woodland in foreground.

Figure 4. Anderson Marsh with woodland covered hills in background.

The climate of Clear Lake basin and Cache Creek drainage is typical of the Coast Range and Central Valley in that it is characterized by warm, dry summers and cool, wet winters. Annual precipitation averages 21 inches.

It is estimated that over a million cubic yards of sediment are transported annually by Cache Creek downstream to its mouth. The settling basin (Figure 5), constructed in 1937, is nearly full; a condition which if uncorrected will accelerate the rate of sediment deposition in the Yolo Bypass and the lower Sacramento River-San Francisco Bay complex.

Figure 5. View of Cache Creek Settling Basin with outlet wier on right and cropland on left.

DESCRIPTION OF THE PROJECT

Implementation of the plan under consideration would provide increased flood protection to lands surrounding Clear Lake and would reduce deposition of Cache Creek sediments in Yolo Bypass and downstream navigation channels. The two components of the plan may be described as follows:

Clear Lake Outlet Channel-(see attached location and configuration sketches, Figures 6 and 7).

Deepening and/or widening about 3.3 miles of the 5-mile long outlet channel and excavating a 1.1-mile long bypass channel are the essential engineering features of this part of the plan. The proposed work would increase the outlet channel capacity from 2,500 to 8,000 cubic feet per second at a nondamaging lake elevation of approximately 1,326 feet. The bypass channel would have side slopes of 1/2 on 1 where excavated in rock and 2 on 1 where excavated in earth. Material excavated from the outlet channel and to construct the bypass channel would be spread on 80 acres of land nearby. A control structure would be constructed in the outlet channel and a weir at the head of the bypass channel so that flows could be held to non-damaging levels in that part of the outlet channel circumvented by the bypass channel. Operation of the two structures would be such that a flow would be maintained in both channels at all times to insure satisfactory conditions for aquatic organisms. Riparian vegetation would be replanted where appropriate along the outlet channel and planted along the banks of the bypass channel. As a condition of project approval, non-Federal interests would be required to prohibit future structural development at Clear Lake below the pre-project 100-year flood level unless such structures were flood-proofed.

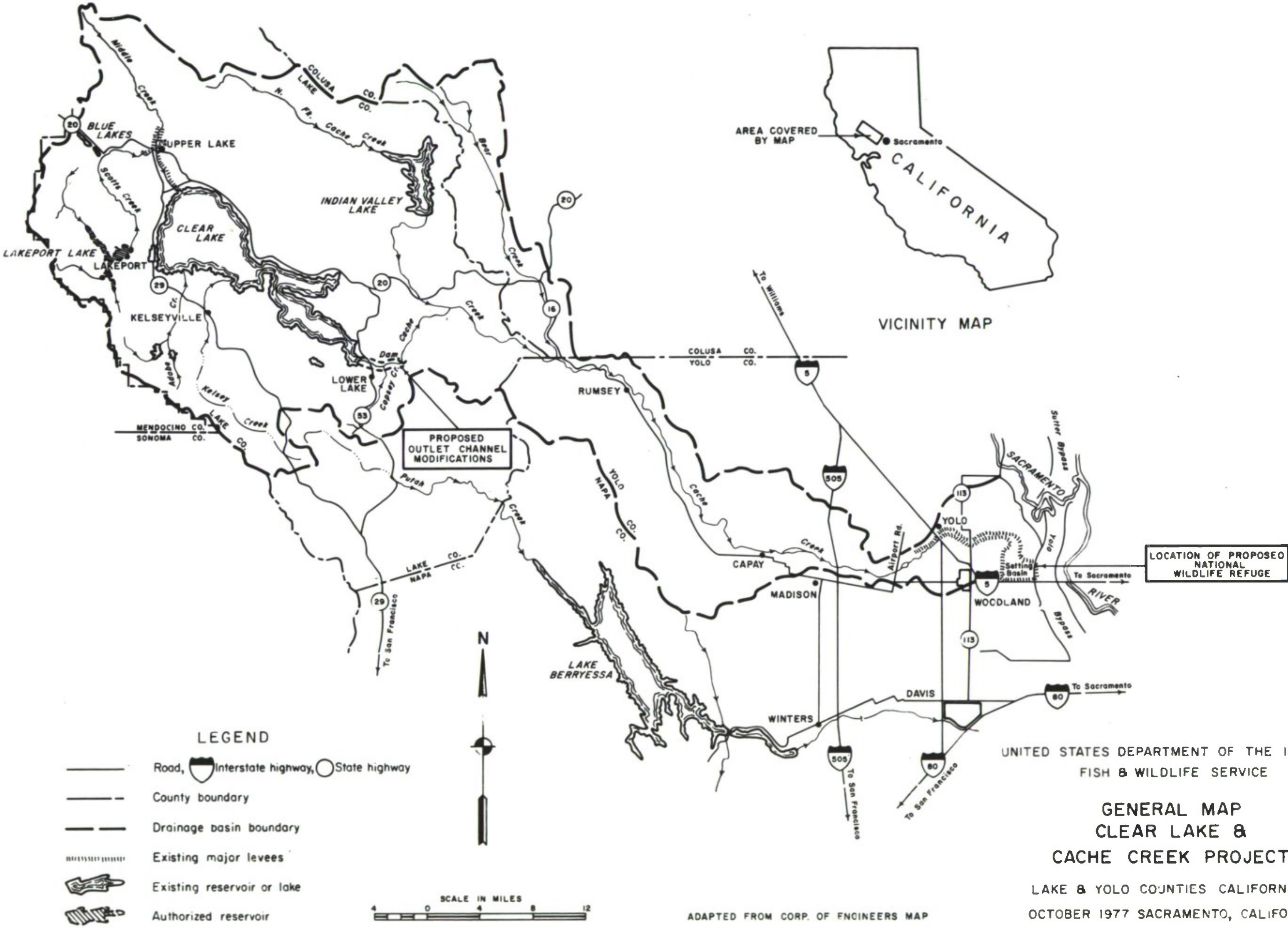
Cache Creek Settling Basin:

This part of the plan provides for restoration of the sediment trap efficiency of the settling basin to 50 percent by increasing the height of its perimeter levees and by reconstructing and enlarging its outlet weir. The perimeter levees would be raised an average of 12 feet and the 1,540-foot long cobble weir would be rebuilt to a length of 1,740 feet. The level of water ponded by the weir would be controlled by means of stop logs. The training levee inside the settling basin would be relocated toward the western perimeter levee to allow fuller utilization of the basin for sediment deposition.

Excavation of 50,000 cubic yards of sediment would be done annually to maintain basin capacity. The excavated sediment would be temporarily stockpiled within the basin until sold to topsoil distributors.

An additional feature of the plan is the enlargement of levees flanking Cache Creek from the settling basin upstream to County Road 102. . All levees would be planted with native vegetation.

The entire 3,600-acre settling basin would be purchased in fee to permit establishment and operation of a national wildlife refuge in conjunction with the sediment control function of the project.

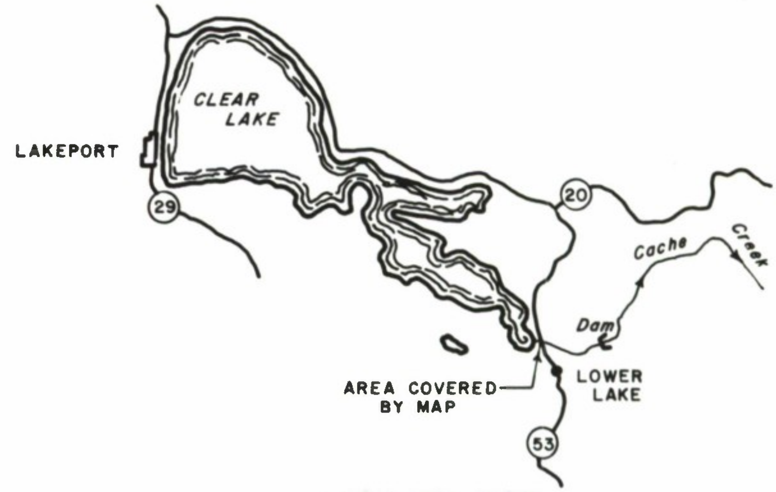


UNITED STATES DEPARTMENT OF THE INTERIOR
FISH & WILDLIFE SERVICE

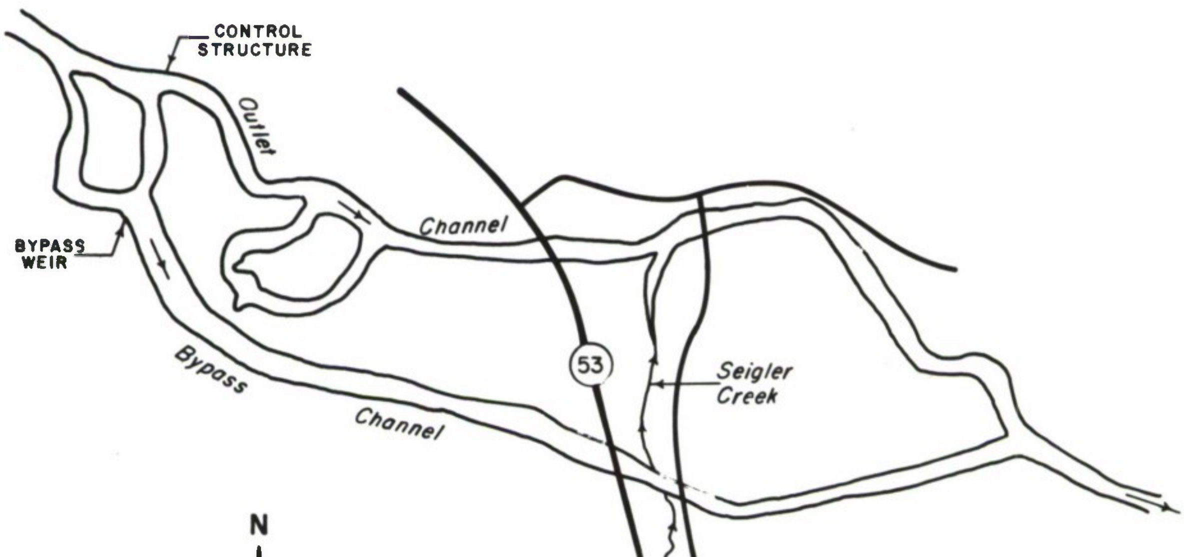
GENERAL MAP
CLEAR LAKE &
CACHE CREEK PROJECT

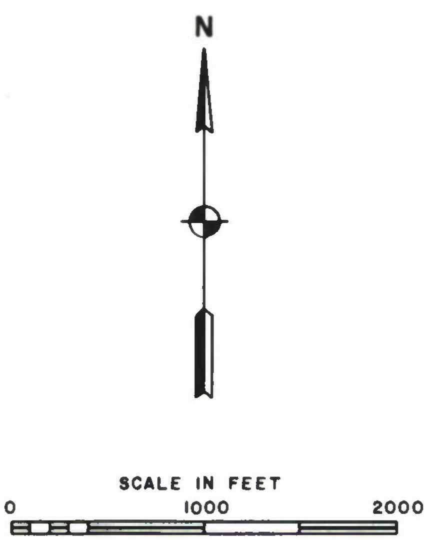
LAKE & YOLO COUNTIES CALIFORNIA
OCTOBER 1977 SACRAMENTO, CALIFORNIA

Figure 6



VICINITY MAP





UNITED STATES DEPARTMENT OF THE INTERIOR

FISH & WILDLIFE SERVICE

LOCATION AND CONFIGURATION OF PROPOSED BYPASS CHANNEL CLEAR LAKE & CACHE CREEK PROJECT

LAKE & YOLO COUNTIES CALIFORNIA

OCTOBER 1977 SACRAMENTO, CALIFORNIA

Figure 7

AQUATIC RESOURCES

Existing Conditions

The aquatic habitat of the project area consists of three discernable types. For the purpose of this report these were identified as the Lake itself, the outlet channel, and Cache Creek downstream from the outlet channel.

Clear Lake, a eutrophic body of water which is the largest natural lake in California, supports a warmwater fishery of statewide importance and interest. Surveys have established the presence of 28 species of native and introduced fish. Black crappie followed by bluegill, white crappie and white catfish are the predominant species taken by boat and shore fishermen. The yield of sport fish is approximately 35 pounds per acre per year. In addition to this sport fishery harvest, commercial fishermen harvest approximately 185,000 lbs. of blackfish and 110,000 lbs. of carp annually.

The outlet channel, while contiguous to the lake proper, provides somewhat different habitat and is a key sport fishing area. Conditions for fish are enhanced in the outlet channel (Figure 8) by the presence of riparian vegetation, strands of marsh vegetation, and the physical variability of the channel bottom and banks. Shade from the trees and brush retards the rate of water temperature increase during summer and thus the dissolved oxygen content remains high. The exposed roots, gravel bars, marshes, and overhanging banks characterizing the channel provide cover and resting sites for fish. These conditions also foster production of a food supply for fish in the form of aquatic and terrestrial invertebrates.

Figure 8. Outlet channel with overhanging riparian vegetation.

Cache Creek proper, which begins at the dam located at the end of the outlet channel, represents a small stream type ecosystem. Prior to construction of the Sacramento River Flood Control Project, when Cache Creek emptied directly into the Sacramento River, and before the construction of dams, levees, and diversions on Cache Creek, the creek supported populations of chinook salmon, American shad, and steelhead trout. The predominant species now found in Cache Creek are members of the minnow family such as squawfish, carp and roach. However, warmwater sport fish such as channel catfish, white catfish, largemouth bass and smallmouth bass are present and support a fishery. Due to agricultural diversions, Cache Creek below Capay Dam to the settling basin, as shown in Figure 9, is an intermittant stream for the most part and therefore does not support a significant fishery. A live stream below Capay ordinarily exists only in the late fall, winter, and spring when the seasonal rainfall occurs and when diversions for agriculture are minimal.

The species selected as aquatic evaluation elements are presented in Table 1. These species are believed to be representative of the aquatic ecosystems being analyzed and their habitat conditions should provide a relative index of the health of the ecosystem under consideration. As can be seen, the elements for the lake and outlet channel are quite similar. This is because the outlet channel is an extension of the lake and the areas are ecologically similar. The evaluation elements selected for the creek are somewhat different. With the creek we have moved into a true stream environment and have included species such as smallmouth bass and squawfish which are more representative of this type of habitat.

Figure 9. Cache Creek near Woodland during the summer months displaying the lack of flow.

Table 1. Aquatic Evaluation Elements.

Species	Lake	Outlet Channel	Creek
Aquatic insects	x	x	x
Crustaceans	x	x	x
Carp	x	x	x
Blackfish	x		
Clear Lake Hitch	x		
Squawfish			x
Smallmouth bass			x
Largemouth bass	x	x	x
Sacramento perch		x	
Bluegill	x	x	x
White crappie	x	x	
Catfish	x	x	x
Mississippi silverside	x	x	
Mosquito fish		x	x

Future Without Project

Without the proposed project the aquatic habitat condition of both Clear Lake and Cache Creek should remain relatively unchanged. In regard to the outlet channel, however, we believe that there would be an approximate 20% reduction in habitat quality. This would be attributed to removal of vegetation and developments along the channel, such as bulkheads, which would degrade the supportive capabilities of the stream. Examples of this type of development are illustrated in Figure 10.

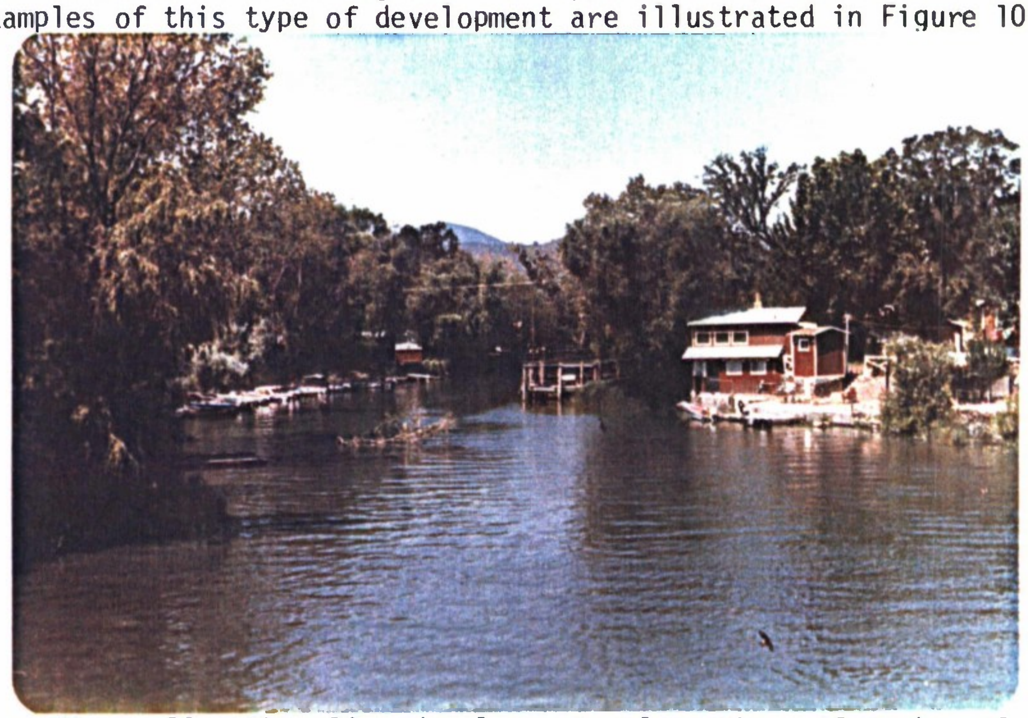


Figure 10. Shoreline developments along the outlet channel.

Future With Project

The principal effect of the project on Clear Lake would be a reduction in both the height and frequency of flood levels. The biological productivity of lacustrine or lake ecosystems depends to a large extent on the shallow water zone, including marshlands which by reason of their contribution of detritus are of basic importance in the aquatic food web. Much marshland vegetation along the lake's periphery has already been lost as a result of lakefront development. In view of the fact that under project conditions all new structures built below the preproject 100-year flood level would have to be flood-proofed (as is now the case by reason of Lake County's participation in the National Flood Insurance Program), it is not anticipated that development in the shallow water zone would differ from that which would occur under without-the-project conditions.

Deepening and widening of the outlet channel would have a detrimental effect on aquatic resources through the removal of snags, boulders, and overhanging riparian vegetation, all of which are important components of stream habitat. Although the bypass channel would constitute new aquatic habitat, it would be of limited value to sportfish because of its uniformity and general absence of features characteristic of a natural stream. Maintenance of both channels would be a recurrent negative factor.

The only project impact of note on Cache Creek from Clear Lake Dam to Cache Creek Settling Basin would be a modification of its flow regime during periods of heavy runoff. Corps of Engineers studies indicate that there would be no significant change in the erosion patterns of Cache Creek due to the increased outflows made possible by the project. Thus, fishery resources in Cache Creek would be largely unaffected.

Summary of Impacts

No significantly adverse, project-related impacts are expected for either Clear Lake or for Cache Creek downstream from the dam. The outlet channel would experience some degradation as a result of the proposed project. However, due to the fact that the amount of aquatic habitat would be significantly increased, (by reason of the bypass channel) post-project values, with proper management, would be higher than without project values, as indicated in Figure 11. A summary of the habitat analysis for all aquatic habitats in the project area is presented in Table 3.

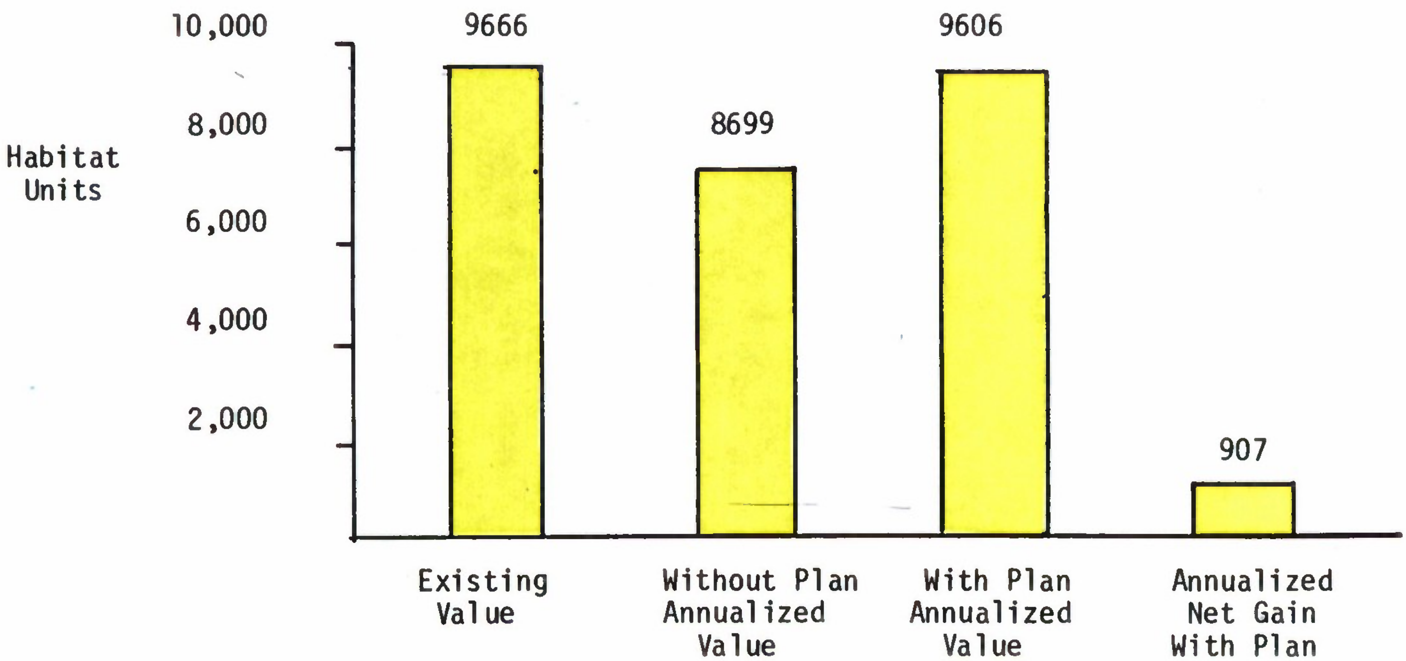


Figure 11. Annualized Aquatic Values for Cache Creek Outlet Channel

TERRESTRIAL RESOURCES

Existing Conditions

The riparian vegetation in the project area, comprised largely of willows, cottonwoods, and various shrubs and herbaceous plants, probably provides habitat for a greater variety of wildlife than any other type. However, the wetlands of Anderson Marsh constitute the largest contiguous fish and wildlife production area in the Clear Lake basin. Field studies have revealed the presence of 91 species of birds in the marsh, including 57 that nest there.

Of particular concern in relationship to the marshes around Clear Lake is the local population of western grebes. Until recent years, the lake was an important breeding area for this species. The reason for the decline is considered to be a combination of human disturbance, habitat destruction, low water, and pesticides. Nesting is now apparently restricted to Long Tule Point on the lake's southern shore east of Lakeport. Even there, continued nesting success is under threat of agricultural and urban encroachment.

Cache Creek from the lake to the settling basin serves as a watering area for wildlife and is therefore of special importance during critically dry periods. Big game species in the project area are the tule elk, black-tailed deer, and black bear. Most of the elk herd, estimated at 125 animals, is located between Bear and Cache Creeks south of Highway 20. Open season for tule elk was closed by act of the California Legislature in 1971 until such time as the statewide population reaches 2,000 animals. Black-tailed deer are common throughout Clear Lake basin along Cache Creek from Clear Lake Dam to Esparto (density is estimated at 10 to 30 per square mile). Over-utilization of the range by cattle has been detrimental to both deer and elk populations. Because of land ownership patterns, most hunting for deer, except in the Cow Mountain area, is by landowners and club members. The black bear population in the project area is low and hunter use is unknown.

Upland game in the project area includes gray squirrel, mountain and valley quail, mourning dove, ring-necked pheasant and black-tailed jackrabbit.

Fur animals such as ringtailed cat, raccoon, mink, gray fox, bobcat, muskrat, beaver and striped skunk inhabit the project area.

Clear Lake is not on a major waterfowl flyway or migration route, but puddle ducks such as pintail, teal, and shoveler can be found there on an intermittent basis during migration and wintering periods. Large numbers of scaup and canvasback have been reported at times of unfavorable weather along the coast. The lake supports a resident population of mallards. Hunting use of the lake is relatively light and success is poor. Even though several thousand ducks may be resting on the lake at one time, their habit of "rafting-up" well away from the shore makes it extremely difficult to approach within shooting distance. Cache Creek Settling Basin attracts large numbers of migratory waterfowl during the winter flood period.

Nongame bird species frequenting the project area include herons, egrets, owls, red-tailed hawks, and many songbirds. These birds and other nongame animals contribute to the public's enjoyment of natural living resources.

Species listed as endangered by the State and Federal Governments which one might expect to see in the project area on rare occasions are the Southern bald eagle and the American peregrine falcon. The California yellow-billed cuckoo, listed as rare by the State, has been observed in Anderson Marsh and in the riparian habitat at the southern end of Clear Lake and along the outlet channel.

For the purpose of habitat evaluation, the terrestrial habitat was divided into fifteen types as displayed in Table 2. With the aquatic evaluation, the species selected as evaluation elements are believed to be representative of the habitat types analyzed and their habitat conditions should provide a relative index of the health of the ecosystem.

Future without project

Without the project a certain amount of both habitat loss and degradation is expected to occur over the period of analysis. The majority of these losses would occur in the area of the outlet channel which will be subject to further development pressure in the future. We believe that the expansion of residential areas and modifications of the banks of the outlet channel would lead to habitat value losses in the outlet channel itself, and the bordering riparian, pasture, grassland, and marsh areas. No change in present land use is anticipated at Cache Creek Settling Basin over the period of analysis without the project.

Future with project

As a direct result of the project, the 100-year flood level at Clear Lake would be lowered from its present elevation of 11.85 feet to 9.6 feet on the Rumsey Gage at Lakeport. While much of the shoreline has been developed for various purposes, important wildlife habitat remains in many areas in the form of riparian vegetation, marshland, cropland and grassland. The marshes at the rim of the lake are of particular importance to wildlife. This habitat is essential to the survival of many species of wildlife and, due to its proximity to the lake, is subject to continued degradation. Inasmuch as new development below elevation 11.85 would be subject to the same constraints on building as now apply, it is not anticipated that habitat destruction due to lakeshore development would be accelerated by the project. It is noted as well that there would be no change in the water regime below a lake elevation of 7.56 feet on the Rumsey gage, an elevation of 2 feet or more above that of the marshes.

Modification of the outlet channel would result in the loss of some riparian vegetation, both woody and herbaceous. Also valuable riparian vegetation along Seigler Creek between the bypass channel and the outlet channel would be adversely impacted if project operation significantly altered the flow regime of that reach of the creek.

Species	Lake	Slough	Grassland	Woodland	Irrigated Pasture	Urban and Builtup	Riparian (urban)	Riparian (rural)	Marsh	Cropland (lake)	Riparian (creek)	Riparian (valley)	Intermittent Waterway (settling basin)	Cropland (basin)	Refuge (basin)
Frogs		X							X						X
Reptiles	X	X	X	X	X	X	X	X	X		X		X		
Grebes	X	X													
Wading Birds	X	X					X	X	X	X				X	X
Waterfowl	X	X			X				X					X	X
Raptors	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Valley Quail							X	X		X	X	X	X		X
R.N. Pheasant												X	X	X	X
Shorebirds					X									X	X
Mourning Dove			X	X		X	X	X		X	X	X	X	X	X
Kingfisher	X	X													
Woodpecker							X	X							
Songbirds			X	X	X	X	X	X	X	X	X	X	X	X	
Jack Rabbit			X	X	X	X				X			X	X	
Rodents			X	X	X	X	X	X	X	X	X	X	X	X	
Muskrat		X							X						X
Raccoon					X		X	X	X	X	X	X			X
Skunk					X				X		X	X	X		
B.T. Deer			X	X	X	X	X	X			X	X			

Table 2. Terrestrial Evaluation Elements.

Since the only effect of the project on Cache Creek from Clear Lake Dam to the settling basin would be a modification of the winter flow regime, there should be no adverse impacts on wildlife resources in that reach of the project.

The establishment of a wildlife refuge within the 3,600-acre Cache Creek Settling Basin would preserve and enhance the wildlife resources at that location. The settling basin now provides important wintering habitat for migratory birds of the Pacific Flyway and, under project conditions, would provide improved habitat. The refuge, appropriately managed, would accommodate approximately 7,300 waterfowl use days and 160,000 shorebird and marshbird use days annually.

Summary of Impacts

As with the aquatic evaluation, no project-related impacts are expected for the Clear Lake area or Cache Creek downstream from the dam. The preponderance of the project-induced impacts are directly related to modification of the outlet channel. Losses or gains for those habitat types exhibiting a significant change are presented in Figure 12. The entire habitat analysis is summarized in Table 3 for the Clear Lake-Cache Creek portion of the project and in Table 4 for the Settling Basin portion.

For that part of the project covered by Table 3, all but one of the habitat types are expected to sustain some loss in value--or no loss--under the without-the-project condition (column 6). The single exception, Segment 1 Urban and Builtup, is explained by reason of anticipated growth in that habitat type. Due to the fact that more natural habitats would have to be degraded to replace losses in Urban and Builtup, and Riparian (urban) no compensation requirement has been listed for those habitat types.

Column 7 of Table 3 displays the net difference in habitat units for each habitat type over the period of analysis with the project in place. The increase in habitat units shown in this column for slough habitat (of benefit to both aquatic and terrestrial animals) is due to project creation of 21.4 acres of slough habitat in the form of the bypass channel. The conversion of some irrigated pasture to grassland, due to the severing of fields by the bypass channel, accounts for the indicated increase in grassland habitat units and the decline in habitat units for irrigated pasture. Habitat unit losses sustained by woodland, riparian, and marsh habitat types are attributable to the impacts of project construction, taking into account the losses that would have been sustained by these habitat types in the absence of the project. Original engineering data presented to us indicated a 8.8-acre loss in riparian (rural) habitat. Subsequent information has shown that the loss of this habitat would be reduced to approximately 2.3 acres. Because of this, the compensation requirement listed for this type habitat, 62.8 acres, would be considerably reduced.

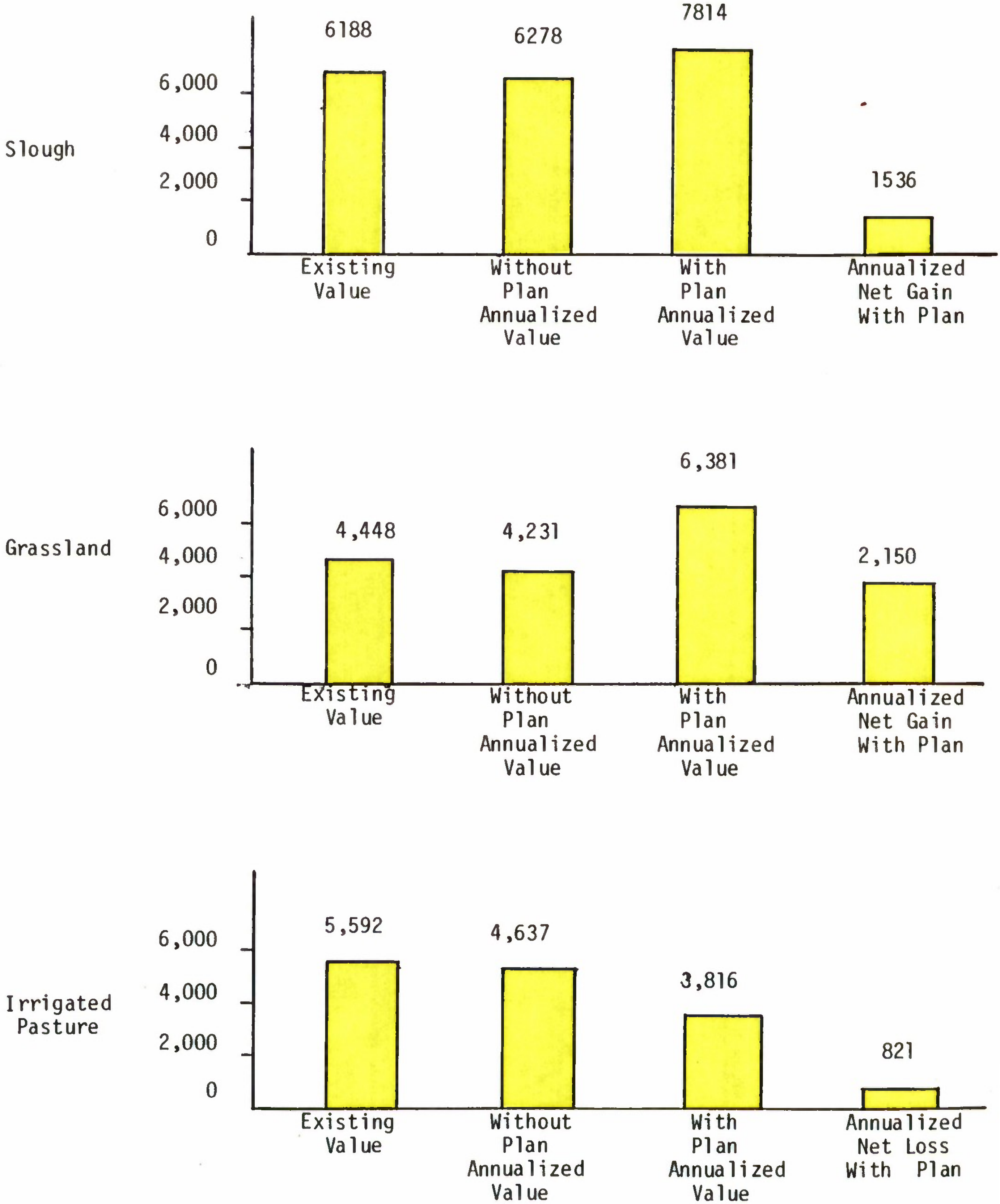


Figure 12. Annualized Terrestrial Values for Cache Creek Outlet Channel

With or without the project, it is assumed that some degradation of marsh habitat at Clear Lake would take place over the period of analysis. However, the degree of degradation would not differ significantly under either condition. Hence, the negative value in column 6 and the zero value in column 7.

Acreage required to compensate for losses (or "gains") shown in column 8 are derived by dividing corresponding values in column 7 by the management potential value (column 4) for the habitat type. If no management potential exists for a particular habitat type compensation requirement is determined by dividing the change in project (column 7) by the Habitat Unit Value (column 3). The supporting rationale is that compensation in kind is attainable only through the improvement or development of comparable habitat to the extent necessary to accommodate the numbers of animals displaced by the project.

As indicated in column 6 of Table 4, no change in present land use and therefore habitat units is anticipated at Cache Creek Settling Basin over the period of analysis without the project. The changes in annualized habitat units with the project (column 7) would occur as a result of habitat improvement in an intermittent waterway, i.e., the training channel within the basin and as a result of the conversion of cropland to higher value seasonal wetland. The conversion of cropland to seasonal wetland would be completed by year 5 of the period of analysis.

DISCUSSION

Clear Lake, Outlet Channel, and Cache Creek:

From the perspective of fish and wildlife conservation, the most desirable plan for flood protection at Clear Lake would be flood plain zoning alone. When additional public interest considerations are taken into account, however, it appears that the selected plan constitutes a reasonable proposal for the relief of flood problems.

Deepening and widening Clear Lake Outlet Channel and excavation of the bypass channel should be accomplished in a manner causing minimal disruption of the streambed and associated riparian vegetation. Measures which would prevent, reduce, and offset anticipated losses are discussed herein.

Of special concern is the effect that channelization would have on riparian habitat in the project area. In California, riparian habitat covers only about 350,000 acres, or less than half of one percent of the State. Of twenty-nine major habitat types in California, the riparian type possibly provides habitat for a greater variety of wildlife than any other. Conditions for fish are also enhanced by woody vegetation at the land-water interface. It is important to recognize that animals displaced from riparian, or other, habitat cannot survive merely by moving into a similar habitat nearby as that habitat is ordinarily supporting wildlife populations to the limit of its carrying capacity. Thus, any loss or degradation of habitat results in an ultimate reduction of wildlife populations.

Table 3. Habitat Analysis 1/

OUTLET CHANNEL, CLEAR LAKE AND CACHE CREEK

(1) Habitat Type	(2) Present Acreage	(3) Habitat Unit Value (mean)	(4) Management Potential (HUV) 2/	(5) Change With Project (acres)	(6) Change Without Project (ann. HU's) 3/	(7) Change With Project (ann. HU's) 4/	(8) Compensation Requirement (acres)
Segment 1 Outlet Channel							
Slough (aquatic)	107.4	90.0	5	+ 21.4	- 966.6	+ 907.0	- 181.4
Slough (terrestrial)	107.4	63.2	10	+ 21.4	- 510.2	+ 1,025.6	- 102.6
Grassland	75.9	58.6	15	+ 29.3	- 217.3	+ 1,933.4	- 128.6
Woodland	3.8	55.0	0	- 0.8	0	- 44.0	+ 0.8
Irrigated Pasture	76.6	73.0	5	- 37.4	- 954.8	- 1,775.4	+ 355.1
Urban & Builtup	30.7	10.0	0	- 3.2	+ 430.0	- 212.0	N/A 6/
Riparian (urban)	1.6	68.3	0	- 0.3	- 6.3	- 14.5	N/A
Riparian (rural)	28.5	75.4	8	- 8.8	- 163.3	- 500.5	+ 62.8
Marsh	7.0	87.7	5	- 0.2	- 18.4	- 17.5	+ 3.5
Segment 2 Clear Lake (below 7.5')							
Lake (terrestrial)	42,120	73.3	0	0	0	0	0
Lake (aquatic)	42,120	86.0	0	0	0	0	0
Marsh	1,660	87.7	5	0	- 3,639.6	0	0
Segment 3 Clear Lake (7.5' - 9.6')							
Builtup & Urban Space	1,120	10.0	0	0	0	0	0
Segment 4 Clear Lake (9.6' - 11.85')							
Builtup & Open Space	1,120	10.0	0	0	0	0	0
Segment 5 Cache Creek							
Riparian (creek)	793	87	0	0	0	0	0
Riparian (valley)	183	53.3	15	0	0	0	0
Creek (aquatic)	97.6	60.0	0	0	0	0	0
TOTAL ACREAGE	47,366.5 5/						

1/ 100-year period of analysis
2/ habitat unit value
3/ annualized habitat units
4/ annualized habitat units (net difference between with- and without-project conditions)
5/ adjusted for double counting
6/ not applicable

Table 4. Habitat Analysis 1/

CACHE CREEK SETTLING BASIN

(1) Habitat Type	(2) Present Acreage	(3) Habitat Unit Value (mean)	(4) Management Potential (HUV) 2/	(5) Change With Project (acres)	(6) Change Without Project (ann. HU's) 3/	(7) Change With Project (ann. HU's) 4/	(8) Compensation Requirement (acres)
<u>Segment 1</u>							
Intermittent Waterway	138	38.9	30	0	0	+ 3,993.0	- 131.1
<u>Segment 2</u>							
Cropland	3,462	56.0	25	- 3,462	0	- 184,178.4	+ 7.367.1
Seasonal Wetland	0	61.0	N/A 5/	+ 3,462	N/A	+ 200,622.9	N/A
TOTAL ACREAGE	3,600						

1/ 50-year period of analysis
2/ habitat unit value
3/ annualized habitat units
4/ annualized habitat units (net difference between with- and without- project conditions
5/ not applicable

The marsh habitat contiguous to Clear Lake and its outlet channel supports a diversity and abundance of fish and wildlife species. A special attribute of this habitat type is its production of nutrients for the growth of micro-organisms and invertebrates which are at the base of aquatic and many terrestrial food chains. Many of the wildlife species utilizing the basin are dependent on the basic production of these wetlands. The Clear Lake sport fishery would be unexceptional without the marshes as they provide areas for fish feeding, rearing and resting. Further, these shallow areas provide fishable waters when wind conditions drive anglers from other parts of the lake.

Diversity is a key characteristic of a productive aquatic ecosystem. The elimination through channelization of holes, snags, emergent vegetation, meanders, riffles, and pools has been shown to be directly correlated with reduction in fish and wildlife populations. Increasing the hydraulic capacity of Clear Lake Outlet Channel would require the removal of marsh and riparian vegetation along portions of the outlet channel above the head of the bypass channel and below the terminus of the bypass channel. Aquatic habitat would be adversely affected in the altered reaches of the outlet channel. Construction of the bypass channel would result in the loss of some marsh and riparian habitat at its junctures with the outlet channel and the loss of irrigated pasture, of value to wildlife, throughout its length. An examination of the data pertaining to twelve cross sections of the outlet channel indicates that approximately half of the channel would be dredged. About 21 acres of aquatic habitat would be created by the bypass channel, but because of the new channel's conformation and uniformity, and because of periodic maintenance dredging, its biological productivity would be lower than that of a natural channel.

Deposition of spoil from channel enlargement and excavation would have originally resulted in the loss of grassland habitat, scattered trees, and riparian habitat. The potential loss of riparian habitat, some 9 acres in all, has been reduced some 6.5 acres by redesigning the easternmost spoil area. The reestablishment of riparian vegetation in areas denuded by construction and the establishment of a riparian corridor along each side of the bypass channel would, in time, offset the destruction of this habitat type.

The outlet channel is an important fishery area from both a production and utilization standpoint. While the additional aquatic habitat developed by reason of the bypass channel would compensate for aquatic habitat losses over the life of the project, there would be a substantial initial loss following project construction. The initial loss could be ameliorated by instituting a management program in both the bypass and outlet channels. The program should include the creation of potholes in the channel bottoms, the placement of large boulders and whole anchored trees in the channels, and the excavation of nesting cavities for catfish in the channel walls.

An additional area of concern is the impact that the bypass channel would have on Seigler Canyon Creek between the new channel and the creek's confluence with the outlet channel. This reach of the creek supports a valuable stand of riparian vegetation which would deteriorate if provision were not made to insure that some portion of Seigler Canyon Creek flows continue past the bypass channel to the outlet channel. A siphon or comparable facility should be installed at the creek bypass juncture to insure flows adequate to support this vegetation.

Losses of irrigated pasture would be largely offset by the conversion of these areas to grassland habitat. Losses of marsh and woodland would be relatively insignificant and, as such, we do not believe that compensatory measures would be necessary. In essence then, we believe that fish and wildlife habitat losses would be satisfactorily compensated with the incorporation of short-term fish habitat improvement measures, and the planting of riparian habitat along the denuded areas of the outlet channel and along the new bypass channel.

Cache Creek Settling Basin:

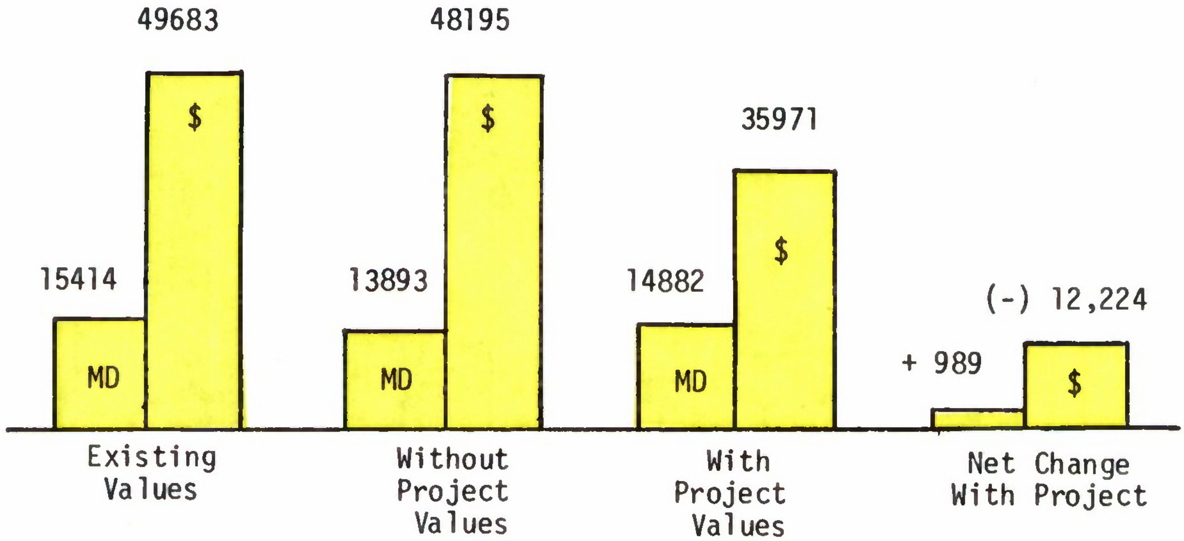
Establishment of a national wildlife refuge at the settling basin would increase the wildlife habitat values within the basin and on surrounding farmlands as well. Establishment of the refuge would contribute significantly to the goals of the National Migratory Bird Management Program, one of which is the preservation of suitable wetlands and the development of new wetlands in the Central Valley of California. It would provide additional wintering habitat for Pacific Flyway waterfowl and thus would complement the Service's operations at Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges and the California Department of Fish and Game's operations at Gray Lodge, Grizzly Island, and Joice Island Wildlife Management Areas. Improving wetland habitat at Cache Creek Settling Basin would facilitate better distribution of waterfowl populations wintering in the Central Valley--a key management consideration for alleviation of waterfowl disease and crop depredation problems.

Economic Evaluations

The major effect of the project in terms of human use and economic values would be felt in the vicinity of the outlet channel and the settling basin. Since it is assumed that the project would have minimal or no effect on Clear Lake itself or on Cache Creek, these segments were not evaluated from a man-day use or monetary perspective. Figure 13 presents a graphical display of those values that would experience a significant change as a result of the project. Tables 5 and 6 present the monetary analysis in terms of human use for both project segments.

Economic justification for the refuge is shown by the least costly alternative means of establishing a refuge supporting equivalent bird use in Yolo County, i.e., acquisition, development, and operation of Cache Creek Settling Basin exclusively for wildlife purposes. It is estimated that the cost of acquiring the refuge in fee title would be about $1,980,000.

Outlet Channel/Fishing



Sediment Basin/Hunting and Visitation

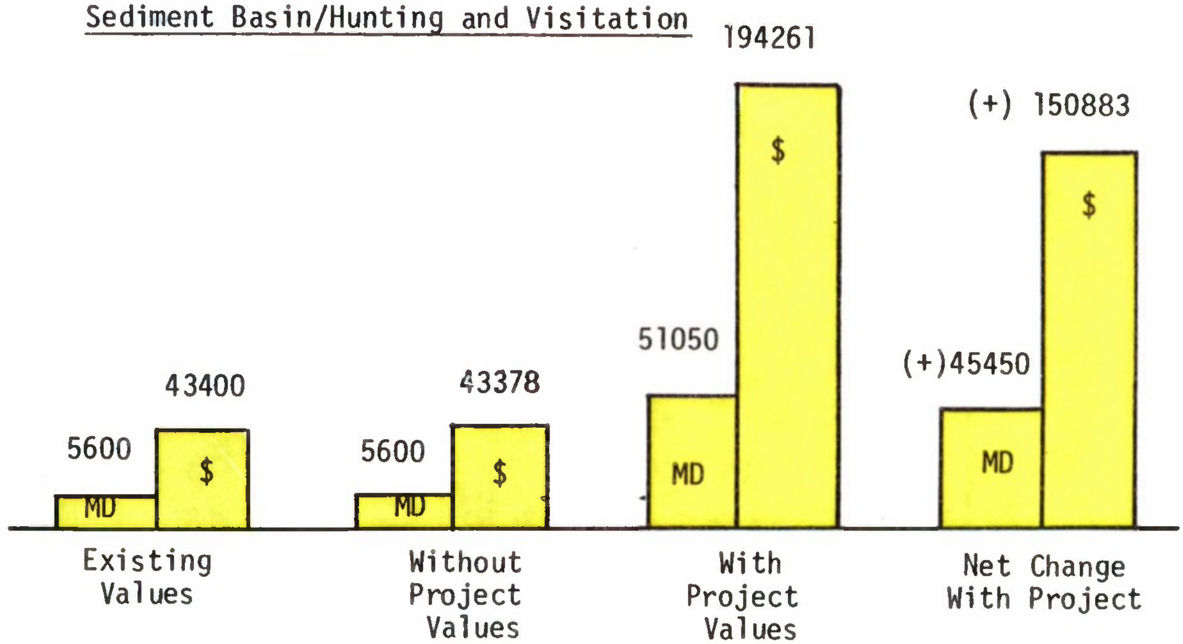


Figure 13. Annualized Consumptive and Nonconsumptive Utilization in Mandays and Dollar Values

Table 5. Monetary Analysis 1/

OUTLET CHANNEL, CLEAR LAKE AND CACHE CREEK

	dollars		
	Without Project	With Project	Difference
Average Annual Equivalent Value	54,089	41,868	- 12,221
Present Worth	815,089	630,966	- 184,123

1/ 100-year period of analysis; 6.625% rate of interest; hunting and fishing use

Table 6. Monetary Analysis 1/

CACHE CREEK SETTLING BASIN

	dollars		
	Without Project	With Project	Difference
Average Annual Equivalent Value	43,374	194,261	+ 150,887
Present Worth	628,606	2,815,390	+ 2,186,784

1/ 50-year period of analysis; 6.625% rate of interest; hunting use and non-consumptive visitation.

Initial development and annual operation costs for facilities and management necessary to achieve basic objectives of the migratory bird management program are estimated at $560,000 and $125,000, respectively.

With respect to your economic analysis for this multiple purpose project, it is our view that all costs associated with the refuge may be properly considered as being fully offset by the non-monetary benefits realized (i.e., bird use-days) because the refuge would serve the interest of the National Migratory Bird Management Program. Additionally, we believe that it would be appropriate to credit the project with benefits equivalent to: (1) the savings achieved by establishing the refuge as a feature of the multiple purpose project in lieu of a single purpose refuge project, and (2) the monetary value attributable to hunting, visitation, and crop depredation prevention.

Present-day crop depredation benefits are estimated at $75,000 annually. The refuge itself would support approximately 6,600 hunter days annually. Due to the refuge, waterfowl hunting on surrounding lands would also increase to 5,450 hunter days annually. The total number of hunter days in and around the settling basin with the refuge in place, 12,050, represents an increase of 7,450 over without the project conditions. Pheasant hunting would occur on the refuge and surrounding lands, but it would generally be done in conjunction with waterfowl hunting during concurrent open seasons. Because of the proximity of the refuge to metropolitan areas, the foregoing levels of hunter use would be attained at the beginning of the analysis period and remain there during the project life. In addition to hunting, refuge activities would include bird watching, wildlife photography, and other forms of nature study. Average annual visitation to the refuge for these nonconsumptive purposes would approximate 39,000 use days. Thus the increase in hunter days and non-consumptive use attributable to the establishment of the refuge is estimated at 7,450 and 39,000 use days with a day use value of $9.00 and $2.00 respectively.

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22 October 2008

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The enclosed documents from USACE Sacramento District are hereby submitted for inclusion in DTIC's technical reports database. The following is a list of documents included in this shipment:

- ADB344304 • Lemon Reservoir Florida River, Colorado. Report on reservoir regulation for flood control, July 1974
- ADB344333 • Reconnaissance report Sacramento Metropolitan Area, California, February 1989
- ADB344346 • New Hogan Dam and Lake, Calaveras River, California. Water Control Manual Appendix III to Master Water Control Manual San Joaquin River Basin, California, July 1983
- ADB344307 • Special Flood Hazard Study Nephi, Utah, November 1998 (cataloged)
- ADB344344 • Special Study on the Lower American River, California, Prepared for US Bureau of Reclamation – Mid Pacific Region and California Dept. of Water Resources…, March 1987
- ADB344313 • Transcript of public meeting Caliente Creek stream group investigation, California, held by, the Kern County Water Agency in Lamont, California, 9 July 1979
- ADB344302 • Initial appraisal Sacramento River Flood control project (Glenn-Colusa), California, 10 February 1989
- ADB344485 • Report on November-December 1950 floods Sacramento-San Joaquin river basins, California and Truckee, Carson, and Walker rivers, California and Nevada, March 1951
- ADB344268 • Reexamination Little Dell Lake, Utah, February 1984
- ADB344197 • Special report fish and wildlife plan Sacramento River bank protection project, California, first phase, July 1979
- ADB344264 • Programmatic environmental impact statement/environmental impact report Sacramento River flood control system evaluation, phases II-V, May 1992
- ADB344201 • Hydrology office report Kern river, California, January 1979
- ADB344198 • Kern River – California aqueduct intertie, Kern county, California, environmental statement, February 1974
- ADB344213 • Sacramento river Chico Landing to Red Bluff, California, bank protection project, final environmental statement, January 1975
- ADB344265 • Cottonwood Creek, California, Information brochure on selected project plan, June 1982
- ADB344261 • Sacramento river flood control project Colusa Trough Drainage Canal, California, office report, March 1993
- ADB344343 • Detailed project report on Kern River-California aqueduct intertie, Kern County, California, February 1974

- ADB344267 Sacramento River Flood Control Project, California, Right Bank Yolo Bypass and Left Bank Cache Slough near Junction Yolo Bypass and Cache Slough, Levee construction, General Design, Supplement No. 1 to Design Memorandum #13, May 1986
- ADB344246 Redbank and Fancher Creeks, California, General Design Memorandum #1, February 1986
- ADB344260 Cache Creek Basin, California, Feasibility report and environmental statement for water resources development Lake and Yolo counties, California, February 1979
- ADB344199 Sacramento River Deep Water Ship channel, California, Feasibility report and environmental impact statement for navigation and related purposes, July 1980
- ADB344263 Sacramento River flood control project, California, Mid-Valley area, phase III, Design Memorandum, Vol. I or II, June 1986
- ADB344262 Marysville Lake, Yuba River, California, General Design Memorandum Phase I, Plan Formulation, Preliminary Report, Appendixes A-N, Design Memorandum #3, March 1977

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